Technical Report No. 32-694

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ABSTRACT

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This Report describes the current best estimate of the *Ranger VII* spacecraft flight path and the way in which it was determined. Deep Space Instrumentation Facility tracking of the spacecraft was virtually continuous from injection to lunar impact. Dramatic TV photos of the lunar surface were received at the Goldstone tracking station during the last 17 min before impacting the Moon, in what was later to be named the lunar "Mare Cognitum." This event marked the first time that man has succeeded in obtaining closeup photographs of the front side of the Moon. Postflight analysis of the tracking data resulted in valuable determinations of the masses of the Earth and the Moon, tracking station locations, lunar ephemeris scale factor, and lunar radius to the *Ranger VII* impact point, to within 0.4 km.

I. INTRODUCTION

This Report describes the current best estimate of the *Ranger VII* spacecraft flight path and the way in which it was determined. Deep Space Instrumentation Facility (DSIF) tracking of the spacecraft was virtually continuous from injection to lunar impact. Postflight analysis of the tracking data resulted in valuable determinations of the masses of the Earth and the Moon, tracking station locations, lunar ephemeris scale factor, and radius of the Moon at the *Ranger VII* impact point. The impact location of *Ranger VII* is known to within 1.0 km, using the standard deviation as a measure of uncertainty.

The primary objective of the *Ranger* Block III (*Ranger 6* through *9*) flights is to obtain TV pictures of the lunar surface which will be of benefit to both the scientific program and the U.S. manned lunar flight program. The *Ranger VII* spacecraft, which was launched from Cape Kennedy on July 20, 1964, and 68 hr 36 min later impacted the Moon on target on July 31, accomplished its primary objective. This flight, as did *Ranger VI*, dramatically demonstrated the capabilities of Earth-based radio guidance. The *Ranger VII* postflight analysis provided significant determinations of the physical constants mentioned above, which are in excellent agreement with similar determinations realized from the *Ranger VI* postflight analysis.

During the launch phase the *Atlas* and *Agena* stages performed within tolerance and injected the spacecraft into a grazing, backside impact trajectory with the Moon.

The Sea of Storms was selected as the general area of impact, since it was the most favorable location for the prevailing lunar surface lighting conditions. Seventeen hours after launch a near perfect midcourse maneuver was executed. The resultant impact point was only 13 km from the center of the chosen target area. This difference is well within the bound expected and is a combination of the errors in the orbit at the time the desired maneuver was determined plus the tolerances of the spacecraft guidance hardware.

Section II of this Report describes the DSIF transponder orbit determination. Comparisons are made among determinations based on premaneuver tracking only, postmaneuver tracking only, and combined estimates based on premaneuver and postmaneuver tracking. Solutions for the masses of the Earth and the Moon, lunar ephemeris scale factor, and tracking station locations are compared to determinations based upon the *Mariner II* (Venus) and previous *Ranger* missions. The determination of the lunar radius at the *Ranger VII* impact point is also presented. The final TV pictures serve as an independent check on the lunar impact point as estimated from the orbit determination process.

Section III discusses the operational considerations associated with the midcourse maneuver policy and the execution of the maneuver. The postflight evaluation described in this Section shows that the response of the spacecraft to the maneuver turn and velocity increment commands was well within the expected tolerances.

Section IV summarizes the key spacecraft events for the mission, and it describes the *Ranger VII* orbit in terms of its trajectory parameters near the Earth, in translunar flight, and near the Moon.

Section V describes the Air Force Eastern Test Range (AFETR) tracking of the *Agena* launch vehicle. The Eastern Test Range (ETR) orbit analysis is divided into three parts: (1) the parking orbit; (2) the postinjection but preretrorocket phases, during which the spacecraft was still attached to the *Agena*; and (3) the postretrorocket orbit of the *Agena*.

Section VI summarizes the key events in the DSIF tracking of the *Ranger VII* mission and gives a general description of the DSIF stations and tracking modes. The determination of the lunar radius at the *Ranger VII* impact point is a direct function of the "recorded" time of impact. The recordings of this event time, as measured by the DSIF Goldstone tracking stations, are presented and discussed.

II. ANALYSIS OF DSIF TRANSPONDER TRACKING DATA

A. Introduction

The purpose of this Section is to present the techniques used to determine the best estimate of the *Ranger VII* spacecraft flight path, and other significant results obtained from the DSIF tracking data. Not only was it possible to determine the spacecraft flight path to a high degree of accuracy, but, in addition, certain physical constants and station location parameters were derived. The 0.06 sec time difference between predicted and observed landing time, and the close agreement between the predicted and observed landing point are both excellent measures of the accuracy of the estimated flight path.

The tracking data are divided into two logical blocks: (1) data taken prior to midcourse maneuver execution, and (2) data taken after midcourse maneuver execution. Consistent answers are obtained when these blocks are analyzed either independently or combined. In the latter, the uncertainties are significantly smaller. The Orbit Determination Program (ODP) of the Jet Propulsion Laboratory (JPL) (Ref. 1) is the principal analysis tool. This Program utilizes an iterative, modified-least-squares technique to find the initial conditions at injection epoch which causes the weighted sum of squares of the residuals (observed minus computed) to be minimized. The

term "modified" is used to indicate that the weighting of individual data types is accomplished in a different manner than in the usual least-squares method.

The initial real-time estimate of the *Ranger VII* spacecraft orbital elements, and initial DSIF acquisition information were provided by ETR. These elements were obtained from tracking the *Agena* vehicle C-band transponder during the period from injection into lunar transfer orbit to *Agena*–spacecraft separation by the ETR tracking stations. ETR tracking data were not used for the flight path determination results presented in this Section. A complete discussion of the ETR data may be found in Section V.

B. Summary of Data Used in Orbit Determination

The DSIF tracking stations provided continuous tracking data from shortly after transfer orbit injection until lunar impact. Figure 1 summarizes the tracking station view periods and their data coverage for the entire mission. Figures 2, 3 and 4 are tracking station stereographic projections which show the trace of the spacecraft trajectory for the view periods shown in Fig. 1. A more complete sequence of tracking events and ground station tracking modes may be found in Section VI.

Table 1 summarizes the tracking data used for both the inflight and postflight orbital calculations and analyses. This Table provides a general picture of the performance of the data recording and handling systems. The JPL Tracking Data Editing Program (TDEP) (Ref. 2) is used to edit all incoming tracking data, and to prepare a data tape for input to the ODP. The total number of data points received are shown in column 3, and the number of points rejected by the editing program are shown in columns 5, 6, and 7. The points in column 5 are the result of applying a doppler differencing test to detect gross errors. Hence, whenever a bad point is found, the following point will automatically fail the difference test and be rejected. It should be noted that during flight operations, no attempt is made to reconstruct data points which were rejected for bad format. A data point is given a bad data condition code when automatic detectors, at the tracking stations, sense that the data would be unusable. These detectors have manual overrides which are used whenever an equipment malfunction is suspected, and during periods when the transmitter is being retuned prior to sending commands to the spacecraft or transferring transmitting assignment to another station. The reason for the excessive number of points shown in column 7 for the first pass for Stations 51 and 59 is given in Section VI. Otherwise, the number of rejected points shown in columns 5, 6, and 7 appear reasonable.

The blunder points shown in column 8 result from applying the rejection limits seen in column 9. These limits are based on experience gained in previous missions, and on the philosophy that it is better to immediately reject questionable points, which could create difficulties in converging to an orbit, than to attempt to salvage every point. This is particularly true when very few data are available during the early phase of the mission. The data shown in column 10 were obtained from the data tapes punched at the stations and mailed to JPL at the conclusion of each tracking pass.

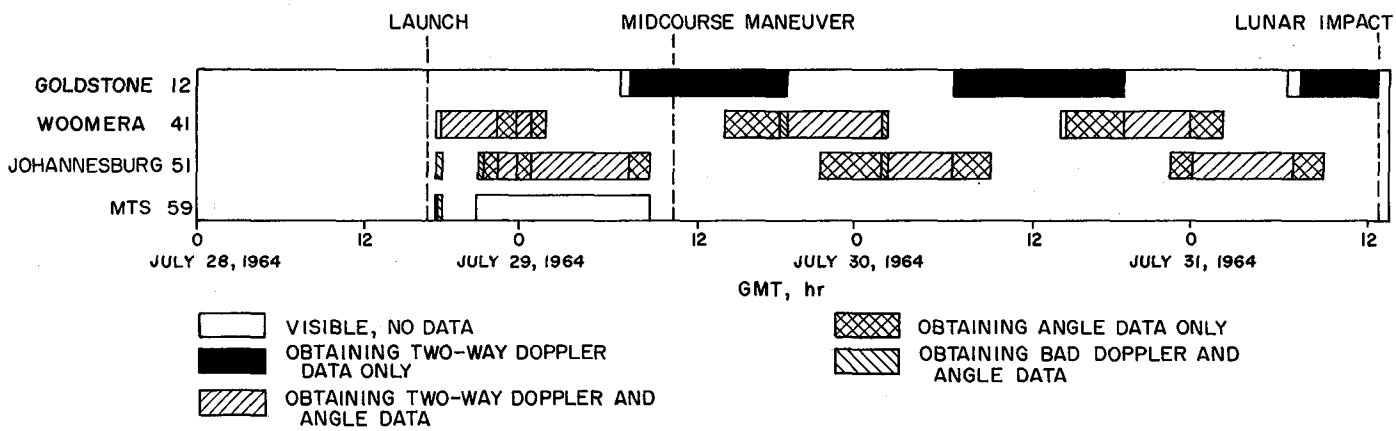


Fig. 1. *Ranger VII* tracking station view periods and data coverage

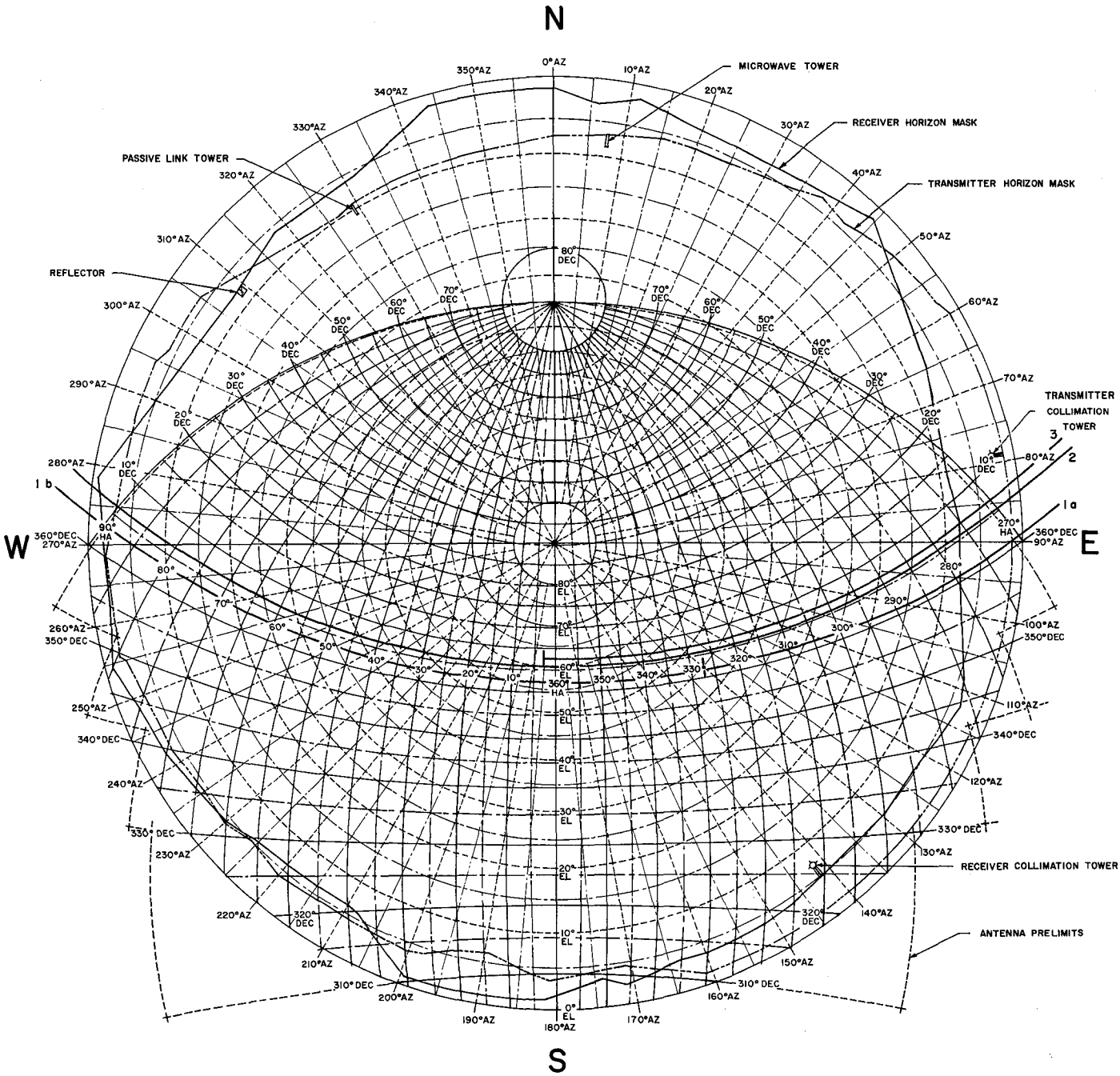
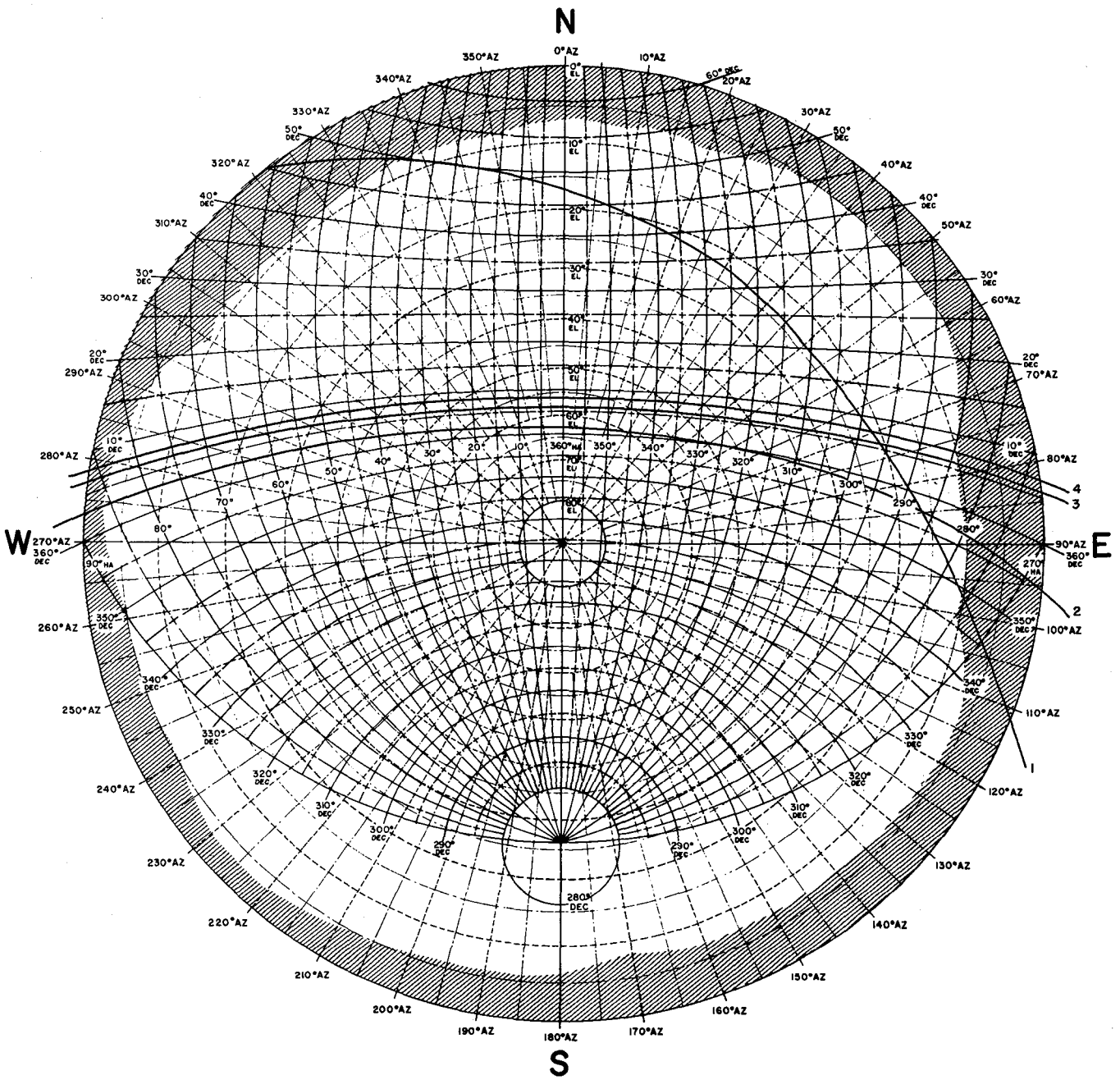


Fig. 2. Station 12 trajectory trace

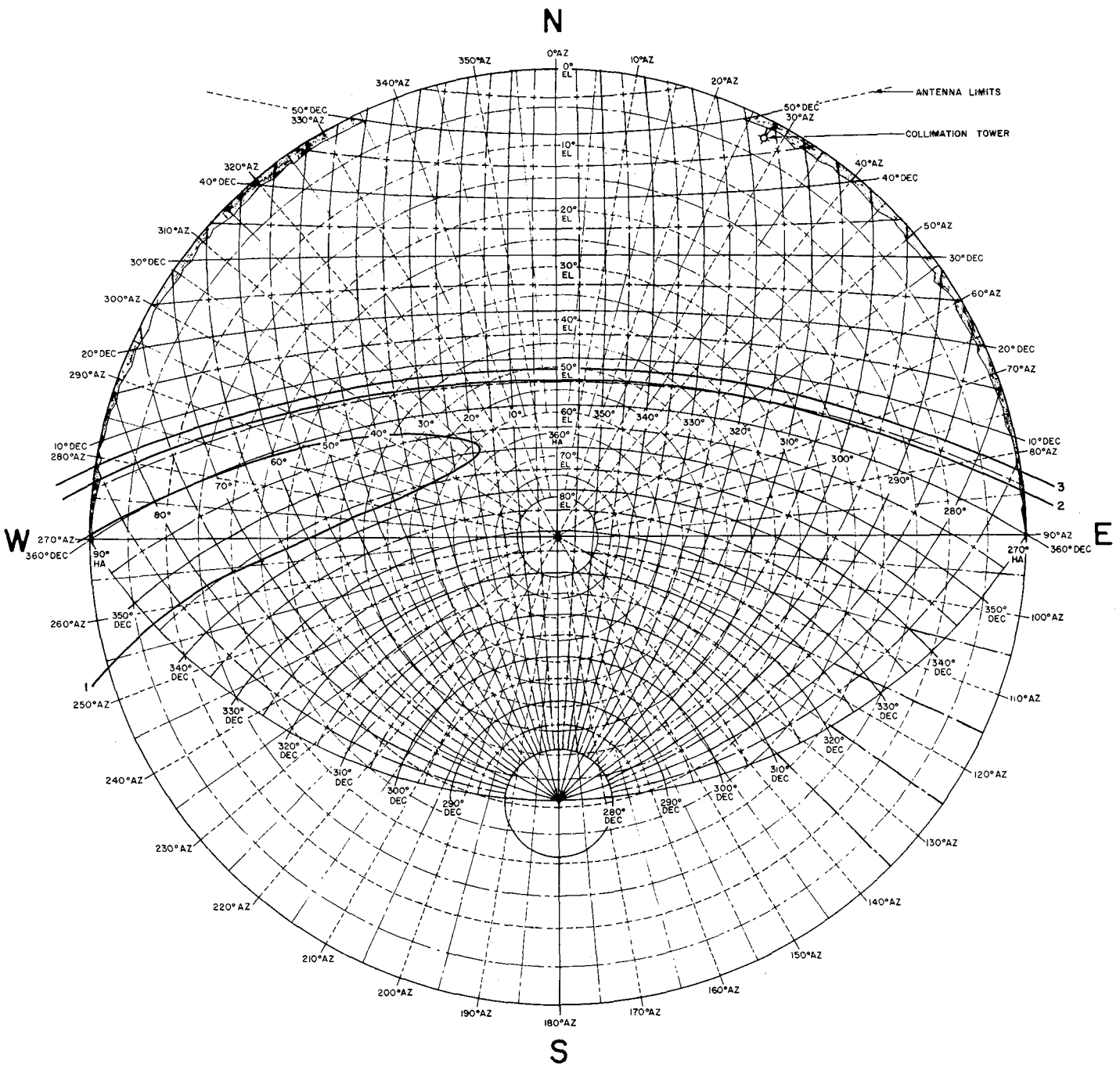


LEGEND

- AZ - EL 10° COORDINATES
- AZ - EL 5° COORDINATES
- HA - DEC 10° COORDINATES
- HA - DEC 5° COORDINATES

1 PREMANEUVER PASS NO. 1
2 PREMANEUVER PASS NO. 2
3 POSTMANEUVER PASS NO. 1
4 POSTMANEUVER PASS NO. 2

Fig. 4. Station 51 trajectory trace



LEGEND

- AZ - EL 10° COORDINATES
- AZ - EL 5° COORDINATES
- HA - DEC 10° COORDINATES
- HA - DEC 5° COORDINATES

1 PREMANEUVER PASS NO. 1

2 POSTMANEUVER PASS NO. 1

3 POSTMANEUVER PASS NO. 2

Fig. 3. Station 41 trajectory trace

Table 1. Summary of data used in orbit determination

Station (1)	Data type (2)	Points received (3)	Number of points used in real time/ (% of received) (4)	Bad format/ (% of received) (5)	Points lost due to bad adjacent point/ (% of received) (6)	Bad data condition code/ (% of received) (7)	Blunder points/ (% of received) (8)	Rejection limits on blunder points (9)	Points used in postflight analysis, obtained from station tapes[a] (10)
Premidcourse									
12 Pass No. 1	2-way doppler	335[b]	66/(19.7)	0/(0.0)	1/(0.3)	5/(1.5)	0/(0.0)	0.2 cps	158
41 Pass No. 1	2-way doppler	323	267/(82.7)	2/(0.6)	12/(3.7)	36/(11.1)	6/(1.9)	0.2 cps	258
	HA	399	325/(81.4)	5/(1.3)	0/(0.0)	9/(2.3)	60/(15.0)	1 deg	0
	Dec	399	325/(81.4)	5/(1.3)	0/(0.0)	9/(2.3)	60/(15.0)	0.1 deg	0
51 Pass No. 1	2-way doppler	78	0/(0.0)	0/(0.0)	4/(5.1)	65/(83.3)	9/(11.5)	0.2 cps	0
	HA	162	23/(14.2)	0/(0.0)	0/(0.0)	127/(78.4)[e]	12/(7.4)	0.3 deg	0
	Dec	162	24/(14.8)	0/(0.0)	0/(0.0)	127/(78.4)[e]	11/(6.8)	0.1 deg	0
51 Pass No. 2	2-way doppler	493	420/(85.2)	15/(3.0)	15/(3.0)	36/(7.3)	7/(1.4)	0.2 cps	428
	HA[c]	700	80/(11.4)	23/(3.3)	0/(0.0)	16/(2.3)	17/(2.4)	0.3 deg	0
	Dec[c]	700	79/(11.3)	23/(3.3)	0/(0.0)	16/(2.3)	18/(2.6)	0.1 deg	0
59[d] Pass No. 1	2-way doppler	71	5/(7.0)	0/(0.0)	1/(1.4)	29/(40.8)	36/(50.7)	0.4 cps	5
Postmidcourse									
12 Pass No. 1	2-way doppler	485	414/(85.4)	8/(1.6)	26/(5.4)	0/(0.0)	37/(7.6)	0.2 cps	414
12 Pass No. 2	do.	721	688/(95.4)	5/(0.7)	3/(0.4)	8/(1.1)	17/(2.4)	do.	687
12 Pass No. 3	do.	675	236/(35.0)[f]	14/(2.1)	15/(2.2)	18/(2.7)	1/(0.1)	do.	634
41 Pass No. 1	do.	447	356/(79.6)	5/(1.1)	32/(7.2)	34/(7.6)	20/(4.5)	do.	355
41 Pass No. 2	do.	295	264/(89.5)	3/(1.0)	6/(2.0)	18/(6.1)	4/(1.4)	do.	251
51 Pass No. 1	do.	329	256/(77.8)	13/(4.0)	15/(4.6)	38/(11.6)	7/(2.1)	do.	256
51 Pass No. 2	do.	474	365/(77.0)	20/(4.2)	35/(7.4)	34/(7.2)	20/(4.2)	do.	381

[a]Data points are obtained from station data tapes to avoid transmission errors.

[b]Includes 161 points of 10-sec data taken during spacecraft reorientation prior to midcourse motor ignition. These data were not included in postflight orbital computations.

[c]Approximately 564 angle pairs were ignored during real-time computations.

[d]Not scheduled to provide tracking data after pass No. 1.

[e]Includes 43 angle pairs taken while spacecraft was below station horizon.

[f]The last real-time orbit was calculated approximately 1 hr before impact. Hence, 378 good doppler points were not used during flight operations.

C. Data Weighting and Error Sources

In the modified-least-squares method used in the ODP, the weighting values for the individual data points are determined by the expected (or measured) "effective variances."[1] The weighting scheme used in the program developed by T. W. Hamilton[2] considers all known error sources to determine the "effective variance." Two classes of error sources are associated with the data used in the *Ranger VII* orbital calculations namely: (1) two-way doppler, and (2) hour angle (HA) and declination (Dec).

The error sources for two-way doppler are:

1. Trajectory computation errors due to rounding errors in the Cowell integration (Ref. 5).
2. Doppler counter rounding errors due to "start" and "stop" gate pulses not occurring at times such that an integral number of cycles has passed, or by variations between "start" and "stop" pulses.
3. Ground station transmitter reference frequency errors either in absolute frequency or reference oscillator frequency drift. The reference frequency is controlled by a temperature stabilized, voltage controlled oscillator (VCO) at Stations 41, 51 and 59, and by either a VCO or a frequency synthesizer (SYNTHESIZER) driven by a rubidium frequency standard at Station 12. The drift rate is 1 part in 10^8/15 min for the VCO, and 3 parts in 10^{11}/hr for the rubidium standard.
4. Doppler counter error due to dropped or added cycles in the presence of a low signal-to-noise ratio.
5. Refraction correction errors due to the difference between the atmospheric model in the ODP and the actual atmosphere at a given time.
6. Spacecraft antenna motion caused by spacecraft tumbling or stabilization motion.

The error sources associated with angular (HA and Dec) are:

1. Angle jitter or variation about the aiming point caused by the antenna drive servomechanisms.
2. Angle correction errors caused by differences between the empirical correction model, which is based on the antenna optical axis, and the RF pointing axis.
3. Angular encoder readout errors caused by inaccuracies in compensation cams. Resolution is plus or minus one count which corresponds to 0.002 deg.
4. Refraction correction errors due to the difference between the atmospheric model used in the ODP and the actual atmosphere at a given time.

The manner in which the error sources enter into the weighting scheme may be seen in the following expression which is used to compute the effective variance σ^2 for weighting a given data point

$$\sigma^2 \triangleq \sum_{i=1}^{6} s_i^2 \; g_i^2 \; \text{Max}\left\{1, \frac{T_{\text{correlation}}}{T_{\text{sample}}}\right\}$$

where

i = basic error source

$s_i^2 \triangleq$ variance of the basic error source

$g_i \triangleq$ sensitivity coefficient

$T_{\text{correlation}} \triangleq$ "correlation width," in seconds, of the basic error source

$T_{\text{sample}} \triangleq$ sample spacing, in seconds

Table 2 shows the functional form of the sensitivity coefficients associated with HA, Dec, and two-way doppler. These coefficients are computed in the ODP, and $T_{\text{correlation}}$, T_{sample}, and the variances (s_i^2) are on the data input record supplied by the TDEP. Specifically, T_{sample} is obtained directly from the sample time indicated in the tracking data. $T_{\text{correlation}}$ and s_i^2 are obtained from control cards read into the TDEP in a single-weight code word[3] by the orbit engineer. The numerical values used for $T_{\text{correlation}}$ and s_i^2 are based on a priori knowledge of the individual tracking stations gained from previous

[1]This approach was first used at JPL by A. R. M. Noton in "Effect of Correlated Data in Orbit Determination From Radio Tracking Data," August 1959 (internal communication). Further discussion was given by A. R. M. Noton, E. Cutting, and F. Barnes (Ref. 3). T. A. Magness and J. B. McGuire have developed mathematical expressions to contrast the performance of least-squares, modified-least-squares, and minimum covariance estimators in terms of the eigenvalues and eigenvectors of the data noise covariance matrix (Ref. 4).

[2]T. W. Hamilton, "Apriori Weighting Coefficients," April 12, 1962 (internal communication).

[3]Two-way doppler data for Station 12 requires the use of two-weight codes to reflect the two methods of controlling the transmitter reference frequency; i.e., VCO and SYNTHESIZER.

Table 2. Sensitivity coefficients, g_i, for HA, Dec and two-way doppler

Error source	Sensitivity coefficient		
	Hour angle	Declination	Two-way doppler
1	1/cos (Dec)	1	1
2	1	1	$1/T_c$
3	1	1	ρ/c
4	Δr (HA)	Δr (Dec)	$1/\sqrt{3T_c}$
5	— —	— —	$\Delta r \dot{\rho}$
6	— —	— —	1

$$\Delta r\,(\mathrm{HA}) = \frac{\cos\phi \sin^2(\mathrm{HA})}{\cos^2\gamma \sin\sigma}\,(\Delta r\,\gamma)$$

$$\Delta r\,(\mathrm{Dec}) = \frac{\cos\gamma \sin\phi - \sin\gamma \cos\phi \cos\sigma}{\cos(\mathrm{Dec})}\,(\Delta r\,\gamma)$$

ϕ = geocentric latitude of tracking station

γ = elevation angle

σ = azimuth angle

$\Delta r\gamma$ = refraction correction for elevation angle

= $57.2957795\ n\ b_1 b_2/340.0$, for $\gamma < 0.3$ rad

= $57.2957795\ n \times 10^{-6} \cot\gamma$, for $\gamma \geq 0.3$ rad

n = index of refraction, nominally 340.0

$b_1 = 1.0 - (1.216 \times 10^5\, b_3\, \gamma) - (51.0 - 300.0\,\gamma)\sqrt{b_3}$

$b_2 = [7.0 \times 10^{-4}/(0.0589 + \gamma)] - 1.26 \times 10^{-3}$

$b_3 = 1/10^3\,(r - RE)$

r = geocentric radius to spacecraft

RE = Earth's radius

$\Delta r\dot{\rho} = 0.0018958\ [(\sin A + 0.06483)^{-1.4} - (\sin B + 0.06483)^{-1.4}]\ n/340.0$

$A = \gamma + T_c\,\dot{\gamma}/2$

$B = \gamma - T_c\,\dot{\gamma}/2$

T_c = doppler count interval, sec

ρ = range from station to spacecraft

missions and on error models for the various error sources. Table 3 presents values of g_i, s_i^2, $T_{\text{correlation}}$, and the resulting contribution to the total weight from each basic error source computed at two different times along the trajectory. The individual data weights for the entire trajectory for a given orbital calculation may be seen in the tracking data residual listings in Appendix E. It is interesting to note the change in data weight when the transmitter was switched from SYNTHESIZER to VCO at 08:41:32 GMT on July 29th in the premaneuver orbit.

The contribution to the total weight due to spacecraft tumbling was considered to be zero since the only tumbling occurred between injection at 17:20:01 and Sun acquisition at 18:06:52 GMT. During this period 30 sec of usable data were received from Station 59, and 8 min of usable data from Station 41. Figure 4 presents a dramatic example of doppler sensitivity to spacecraft motion. The doppler residuals seen in the Figure were observed at Station 41 during Sun Acquisition sequence. The residuals to the left of 18:00:00 GMT show spacecraft tumbling prior to exit from the Earth's shadow, and those to the right show the motion of the spacecraft while it was searching for the Sun. When the spacecraft was in the cruise mode maintaining Sun–Earth lock, the maximum change in doppler phase due to the limit cycle was 0.1 cycles.

In Table 2 it may be seen that the effect on the total weight for the doppler counter error sources (rounding and added or dropped cycles) may be minimized by using a long counting base. This is accomplished at the DSIF stations by taking continuous count doppler with a dual counter system. That is, one counter continuously counts cycles that have passed from some start time. When it receives a pulse to supply a doppler sample, it transfers its contents to another counter without interrupting its counting action. The contents of the second are then translated from binary-coded decimal (BCD) to decimal and punched on paper tape. Doppler refraction correction (error source 5) is not a predominant error source except possibly for the early part of a mission when the elevation angle rates are high. For this mission, only 30 sec of early usable doppler data were available from Station 59. The transmitter reference frequency drift (error source 3) is a major contributor to the total doppler weight for stations using the VCO; but is negligible for Station 12 when using the SYNTHESIZER. For example, near lunar encounter where the contribution from this source is a maximum, the error attributed to the frequency drift for the SYNTHESIZER is $\sigma^2 = 0.03756 \times 10^{-4}$, and for the VCO it is $\sigma^2 = 375.6 \times 10^{-4}$.

For the angular data types (HA, Dec), the predominant error sources are angle correction errors and encoder errors. During *Ranger VII* correction errors of 0.1 deg and encoder errors of approximately 0.02 deg peak-to-peak were noted. Plots of these errors may be seen in Figs. 5 and 6 in which the residuals represent the error remaining after the angle corrections had been applied. Due to these large errors, angular data were not used in the orbit calculations except during the early phase of the mission. They were very helpful in obtaining the first orbital estimates since there was a scarcity of usable data during the first two hours after injection. The contribution due to refraction correction errors was relatively small and was not used for local elevation angles greater than 17 deg. The affect of angle jitter errors on

Table 3. Contribution from individual error sources to total weight for *Ranger VII* mission

Error source	Early doppler (range = 55,000 km)				Late doppler (range ≅ 383,000 km)			
	g_i^2	s_i^2	Correlation width, sec	σ_i^2, cps^2	g_i^2	s_i^2	Correlation width, sec	σ_i^2, cps^2
(1) Computing error	1	1.1×10^{-5}	36,000	65.6×10^{-4}	1	1.1×10^{-5}	36,000	65.6×10^{-4}
(2) Counter rounding error	2.78×10^{-4}	0.16	1	0.47×10^{-4}	2.78×10^{-4}	0.16	1	0.47×10^{-4}
(3) Transmitter reference frequency error	0.0189	0.41×10^{-2}	600	7.76×10^{-4} (for VCO)	0.917	0.41×10^{-2} (VCO) 0.41×10^{-6} (SYNTHESIZER)	600	376.1×10^{-4} (VCO) 0.03761×10^{-4} (SYNTHESIZER)
(4) Dropped or added cycles	5.56×10^{-3}	0.96	1	5.43×10^{-4}	5.56×10^{-3}	0.96	1	5.34×10^{-4}
(5) Refraction correction error	1.11×10^{-6}	0.04	1,000	0.007×10^{-4}	3.92×10^{-6}	0.04	1,000	0.026×10^{-4}
(6) Spacecraft motion		Zero for *Ranger VII*				Zero for *Ranger VII*		
Total	$\sum_{i=1}^{6} \sigma_i^2 = 79.24 \times 10^{-4}$ $\sigma = 0.089$				$\sum_{i=1}^{6} \sigma_i^2 = 446.6 \times 10^{-4}$ (VCO) $= 71.5 \times 10^{-4}$ (SYNTHESIZER) $\sigma = 0.211$ (VCO) $= 0.085$ (SYNTHESIZER)			

Error source	Early angles (range = 55,000 km)				Late angles (range ≅ 383,000 km)			
	g_i^2	s_i^2	Correlation width, sec	σ_i^2, deg^2	g_i^2	s_i^2	Correlation width, sec	σ_i^2, deg^2
(1) Angle jitter	Dec = 1 HA = 1.026	9.0×10^{-6}	1	Dec = 0.09×10^{-4} HA = 0.0924×10^{-4}	Dec = 1 HA = 1.008	9.0×10^{-6}	1	Dec = 0.09×10^{-4} HA = 0.0907×10^{-4}
(2) Angle correction error	1	1.0×10^{-4}	20,000	333.33×10^{-4}	1	1.0×10^{-4}	20,000	333.33×10^{-4}
(3) Angle encoder error	1	1.44×10^{-6}	1	0.0144×10^{-4}	1	1.44×10^{-6}	1	0.0144×10^{-4}
(4) Refraction correction error	Dec = 1.26×10^{-4} HA = 2.48×10^{-4}	4.0×10^{-2}	1,000	Dec = 0.84×10^{-4} HA = 1.65×10^{-4}	Dec = 4.12×10^{-4} HA = 2.44×10^{-4}	4.0×10^{-2}	1,000	Dec = 2.75×10^{-4} HA = 1.63×10^{-4}
Total	$\sum_{i=1}^{6} \sigma_i^2 = 334.27 \times 10^{-4}$ (Dec) $= 335.06 \times 10^{-4}$ (HA) $\sigma = 0.183$ (Dec) $= 0.183$ (HA)				$\sum_{i=1}^{6} \sigma_i^2 = 336.18 \times 10^{-4}$ (Dec) $= 335.06 \times 10^{-4}$ (HA) $= 0.183$ (Dec) $= 0.183$ (HA)			

Note: sample rate = count time = 60 sec

$$\sigma = \left[\sum_{i=1}^{6} \sigma_i^2\right]^{1/2} = \left[\sum_{i=1}^{6} g_i^2 s_i^2 \operatorname{Max}\left\{1, \frac{T_{\text{correlation}}}{T_{\text{sample}}}\right\}\right]^{1/2}$$

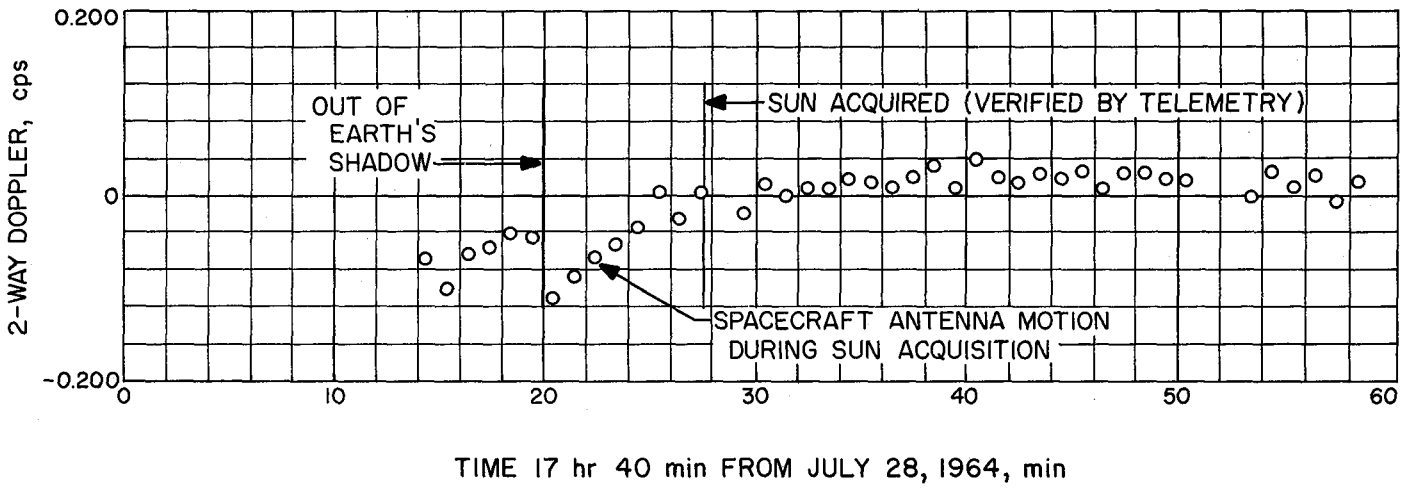


Fig. 5. Station 41 doppler variation during Sun acquisition

the total HA weight was determined by the declination angles seen during the mission. For *Ranger VII*, declination angles ranged between 349 and 7.8 deg. In Table 2 it may seem that this error source contributes very heavily to total HA weight for declination angles near 90 and 270 deg.

For both doppler and angular data, an additional error source exists; namely, the differences in absolute time between the station clocks. For *Ranger VII*, an experimental method was used to determine these differences to within 1 msec during flight operations. This method is based on two stations measuring the time of a specific telemetered event (occurring when both stations have the spacecraft in view) and correcting these times for differences in station–probe range. The event measured was a telemetry synchronization pulse which occurred every 1000 sec. At the stations the event time was measured using an analog recorder operating at a paper speed of 60 in./sec. In addition to the synchronization pulse, a BCD time code and a 100 pps timing reference was recorded. It was assumed that the signal transit time through the equipment (i.e., from antenna to recording device) was the same for all stations. Results of these measurements indicate a 6 msec difference between the clocks at Stations 12 and 41, and a 3 msec difference between Stations 12 and 51. The detailed affect of these biases on the estimate of the *Ranger VII* flight path is small but is being carefully investigated.

The sample spacing to be used at the tracking stations is determined by the tradeoff between doppler counter rounding errors and truncation errors occurring in the doppler frequency computations. The expression used in the ODP for these computations is

$$f(t_{ob}) = \int_{T - \frac{1}{2}\tau}^{T + \frac{1}{2}\tau} \ddot{F}(t)\mathrm{d}t$$

where $f(t_{ob})$ = the integrated doppler frequency, which should be observed by a station at time t_{ob}.

$T = t_{ob} - \frac{1}{2}\tau$

τ = sample spacing

$F(t)$ = the instantaneous frequency of the doppler shift which should have been observed at time t.

This integral is evaluated by expanding a Taylor series about T and integrating term by term leading to

$$f(t_{ob}) = \tau F(T) + \frac{\tau^3}{24}\ddot{F}(t) + O(F^{iv})$$

Thus, the truncation error is a function of τ and the fourth derivative of the frequency (which is, in turn, dependent on the fifth derivative of range). For this mission sample spacing had to be reduced during three phases of the flight: (1) near Earth, (2) during maneuver motor thrusting, and (3) near lunar encounter. For these phases sample spacings of 5, 10, and 10 sec, respectively, were used. At all other times a sample spacing of 60 sec was used.

It is believed that the total weight applied to angular and two-way doppler data is somewhat conservative, and that all error sources which contribute a measurable amount of the total weight have been taken into account.

D. Premaneuver Orbit Based on Premaneuver Tracking Only

Table 4 summarizes the data used for the postflight analysis of the premaneuver data, and presents the statistics pertaining to these data. It will be noted that only two-way doppler data were used in the orbit calculation. Angular data were not used because of biases due to the inadequacy of the angular correction model. These biases may be seen in Figs. 6 and 7, and the correction model errors will be explained more fully in Section VI. From Table 4 it may be seen that the noise level for all stations except Station 59 varied between 0.001 and 0.022 m/sec. At Station 59 the noise level was higher (0.031 m/sec), since a higher sample rate of 1/5 sec was required due to high spacecraft acceleration. Residual plots for the premaneuver data may be seen in Figs. 8 through 13. It should be noted that these plots do not pertain to this particular calculation; but, as will be pointed out in the section on combined results, they deviate by an insignificant amount from the residuals of this orbit.

Table 5, columns 1 through 3, shows the parameters which were estimated and the a priori information used. For this orbital calculation, large a priori uncertainties were placed on all parameters so that the final solution would be determined solely by the tracking data. For the station location uncertainties, the X_1, X_2, X_3 coordinate system (centered at the tracking station) was used. In this system, X_1 and X_2 are in the equatorial plane with X_2 in the longitude direction and X_1 normal to the Earth's spin axis. X_3 is in the direction of the Earth's spin axis. A 1-σ a priority of 500, 500, and 100 m was used for X_1, X_2, and X_3, respectively, and then rotated into the station spherical coordinate system (radius, latitude, and longitude) for input into the ODP.

Column 4 of the Table contains the statistics associated with this orbital calculation at injection epoch, maneuver epoch, and lunar impact. At injection epoch, the smallest uncertainty in the Cartesian orbital elements appears in the X direction, and the largest in the Z direction. This is as expected since the spacecraft orbital plane is almost coincident with the X–Y plane, and the spacecraft motion is predominently in the X direction. The doppler measurement is also in this direction; therefore, X and Y should be well determined. Since Z is normal to the doppler measurement, it will not be as well determined. The uncertainty in the universal gravitational constant times the mass of Earth ($GM_\oplus$) was re-

Table 4. Statistics on premaneuver data

Station	Number of doppler points	No a priority from postmaneuver			With postmaneuver as a priority		With postmaneuver as a priority plus *REM* constraint	
		Standard deviation[a], cps	Mean, cps	Remarks[b]	Standard deviation, cps	Mean, cps	Standard deviation, cps	Mean, cps
12	61	0.0079	+0.0031	Data taken below 17-deg elevation using rubidium frequency standard	0.0082	0.0018	0.0079	−0.0003
	23	0.0105	−0.0055	Data taken above 17-deg elevation using rubidium frequency standard	0.0105	−0.0040	0.0102	−0.0041
	74	0.0142	+0.0036	Data taken above 17-deg elevation using voltage controlled osc (VCO)	0.0142	−0.0023	0.0141	0.0000
41	252	0.0100	+0.0012	Data taken above 17-deg elevation using VCO	0.0102	−0.0003	0.0100	−0.0006
	6	0.0059	−0.0016	do.	0.0060	−0.0003	0.0060	−0.0041
51	428	0.0100	−0.0019	do.	0.0102	0.0026	0.0100	−0.0010
59	5	0.2010	−0.0203	do.	0.1980	−0.0080	0.1970	0.1390

[a]In the *Ranger VII* station configuration for L-band frequency, 1 counted doppler cycle ≅ 0.156 m.

[b]Remarks concerning rubidium frequency standard and VCO refer to method used to provide ground station transmitter reference frequency.

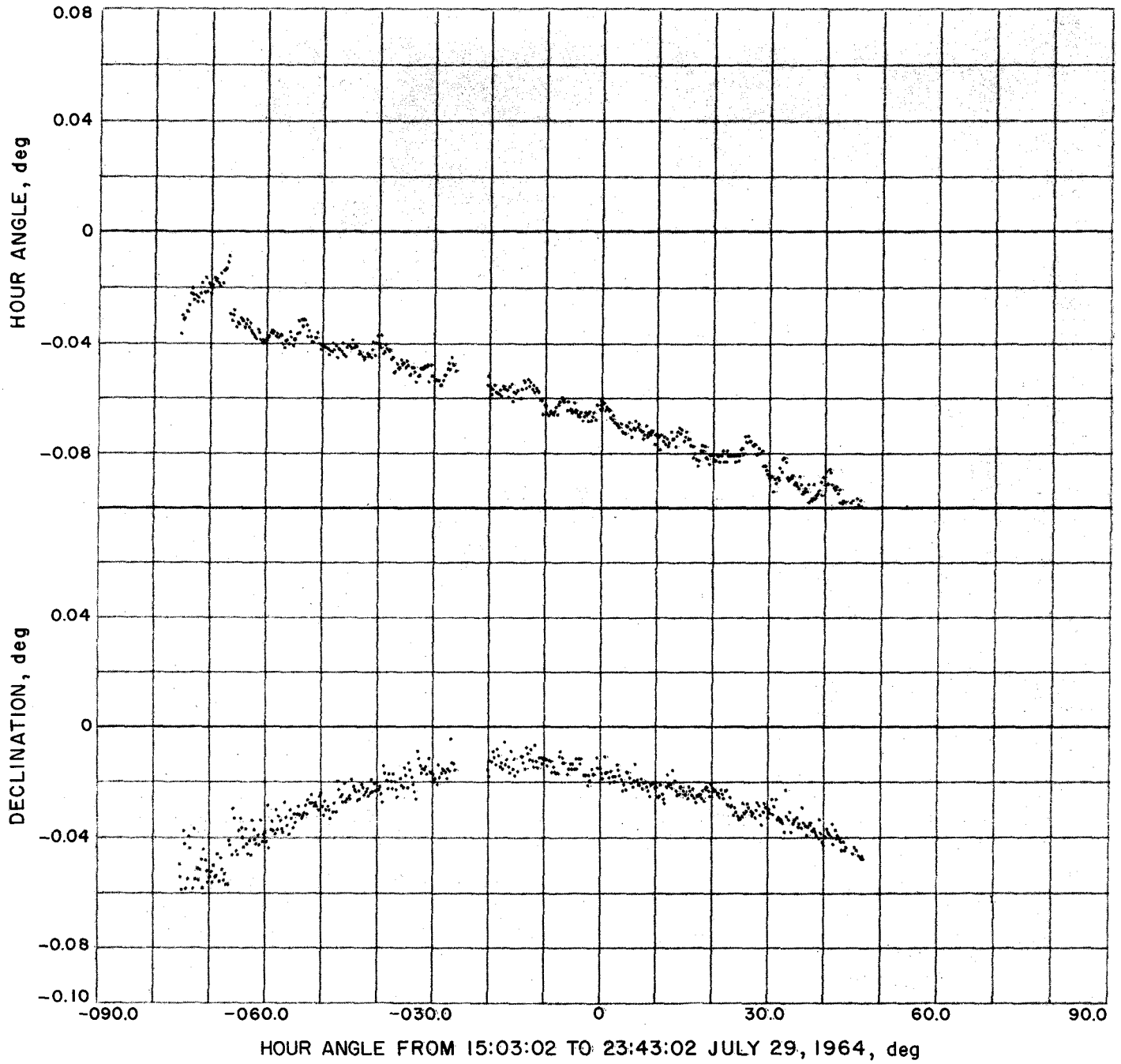


Fig. 6. Station 41 angular residuals

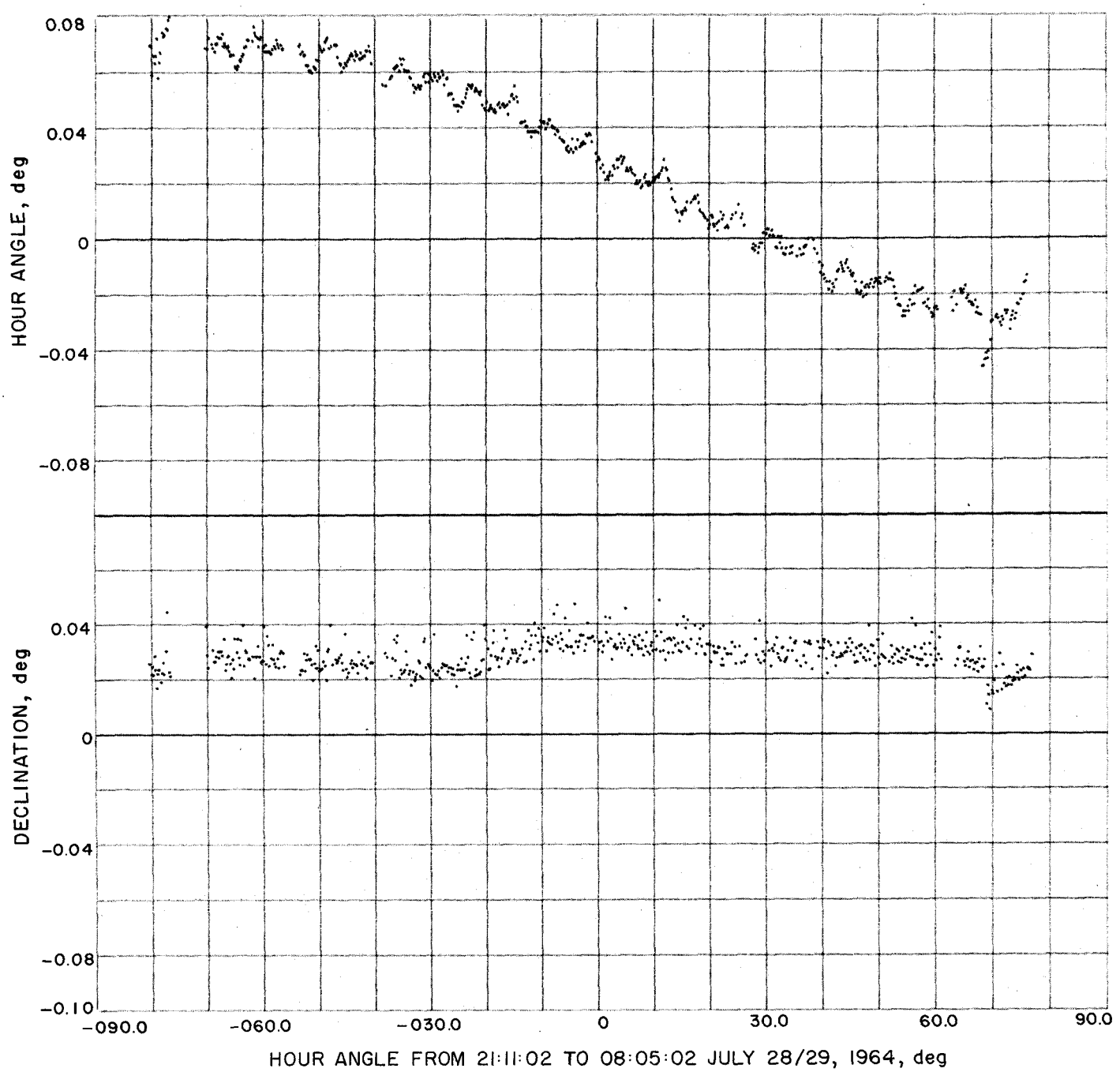


Fig. 7. Station 51 angular residuals

Table 5. Estimated parameter statistics

Estimated parameter (1)	Units (2)	A priority (one sigma) (3)		Standard deviations on parameters using premaneuver data only (4)			Standard deviation on parameters using premaneuver data with a priority from *postmaneuver data* (5)			Standard deviations with *REM* constraint applied to premaneuver orbit (using postmaneuver data as a priority) at injection epoch (6)	Standard deviations on parameters using postmaneuver data only (7)		Standard deviations on parameters using postmaneuver data with a priority from premaneuver data (8)		Standard *deviations* with *REM* constraint applied to postmaneuver *orbit at* impact epoch (9)
		Actually used[d]	*Presently* accepted[a]	*Injection* epoch	*Maneuver* epoch	*Impact* epoch	*Injection* epoch	*Maneuver* epoch	*Impact* epoch		Maneuver epoch	Impact epoch	Maneuver epoch	Impact epoch	
X[b]	km	1×10^4	5	0.240	3.498	29.713	0.068	0.550	2.671	0.054	2.528	2.382	0.554	0.277	0.216
Y	km	1×10^4	5	0.318	8.838	45.244	0.109	1.887	4.340	0.102	3.946	3.719	1.891	1.577	0.270
Z	km	1×10^4	5	0.465	19.809	24.532	0.150	3.675	4.299	0.136	8.500	6.435	3.616	4.335	0.834
DX	m/sec	1×10^7	10	0.588	0.059	13.292	0.076	0.007	1.162	0.074	0.016	0.666	0.006	0.411	0.076
DY	m/sec	1×10^7	10	0.679	0.082	35.636	0.323	0.016	3.170	0.295	0.029	1.918	0.018	1.212	0.195
DZ	m/sec	1×10^7	10	1.788	0.157	12.264	0.463	0.033	3.417	0.372	0.061	3.134	0.035	2.044	0.376
$GM_\oplus$	km^3/sec^2	10	4	6.315			1.531			1.402	8.746		1.530		1.401
$GM_\leftmoon$	km^3/sec^2	5	0.3	4.999			0.167			0.156	0.402		0.167		0.154
REM	m	50	20	50.000			36.300			7.341	44.948		36.230		7.339
GB	—	0.3	0.2	0.300			0.300			0.300	0.300		0.300		0.300
Station 12		For all Stations: $X_1 = 500$ m $X_2 = 500$ m $X_3 = 500$ m													
Radius	m			133			58			58	59		58		57
Latitude	deg			0.00107			0.00074			0.00074	0.00074		0.00074		0.00074
Longitude	deg			0.00348			0.00062			0.00026	0.00098		0.00062		0.00026
Station 41															
Radius	m			96			58			57	64		58		56
Latitude	deg			0.00093			0.00077			0.00077	0.00079		0.00077		0.00077
Longitude	deg			0.00375			0.00064			0.00032	0.00107		0.00064		0.00032
Station 51															
Radius	m			75			25			24	44		25		23
Longitude	deg			0.00346			0.00062			0.00028	0.00101		0.00062		0.00028
Station 59[c]															
Radius	m			439			320			320	452		320		320
Longitude	deg			0.00420			0.00148			0.00148	0.00499		0.00148		0.00148

[a] Indicates approximate known uncertainty before estimate, which in most cases is a magnitude smaller than a priority actually used.

[b] Space-fixed geocentric equatorial Cartesian coordinates.

[c] Station 59 provided only 30 sec (5 points) of early data and was not scheduled to provide tracking data during subsequent view periods.

[d] *These a priori values were used in the orbital calculations for premaneuver data only (column 4), and postmaneuver data only (column 7).*

NOTE: All impact statistics are in geocentric coordinate system rather than selenocentric.

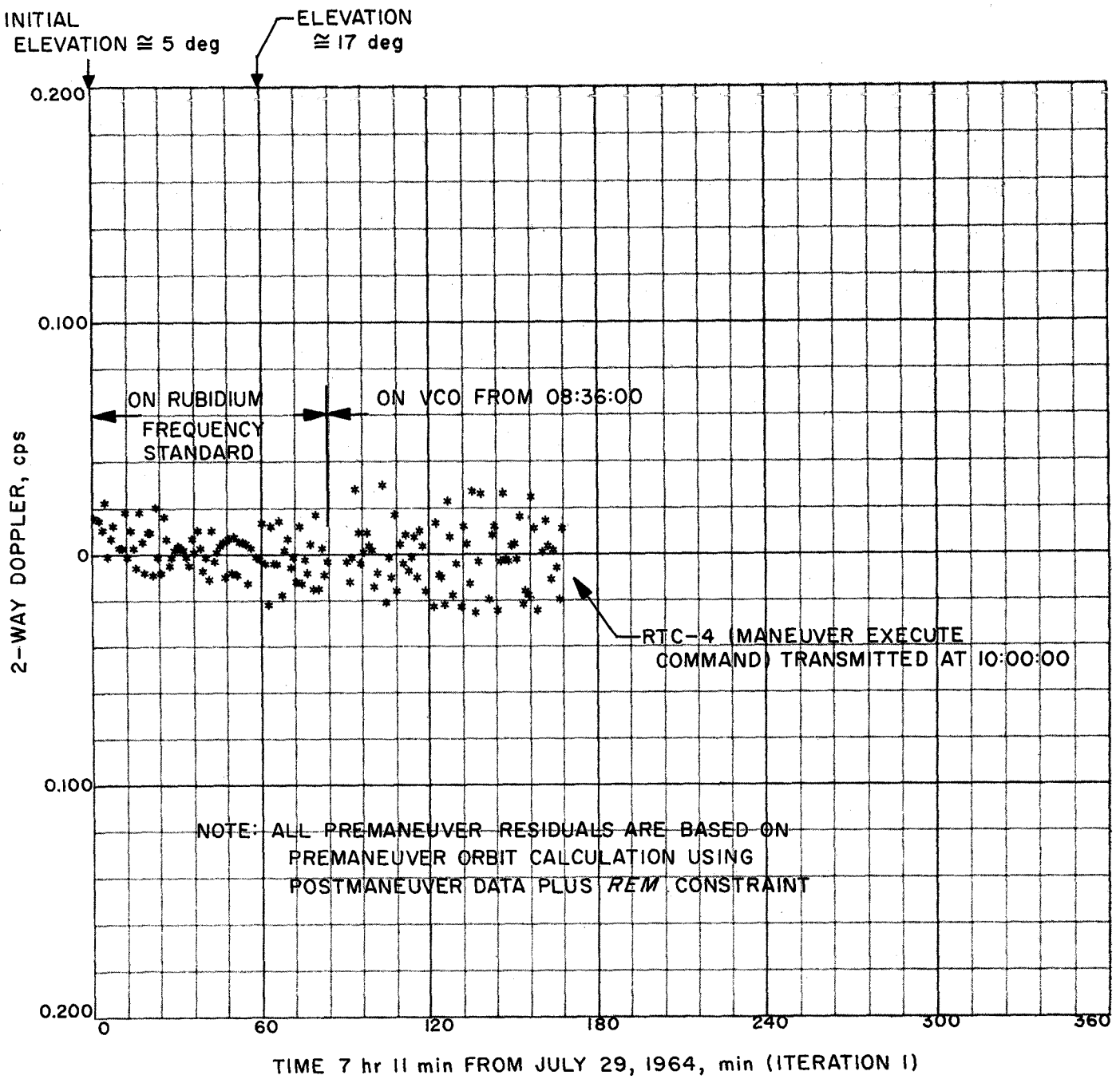


Fig. 8. Station 12 premaneuver pass No. 1 two-way doppler residuals

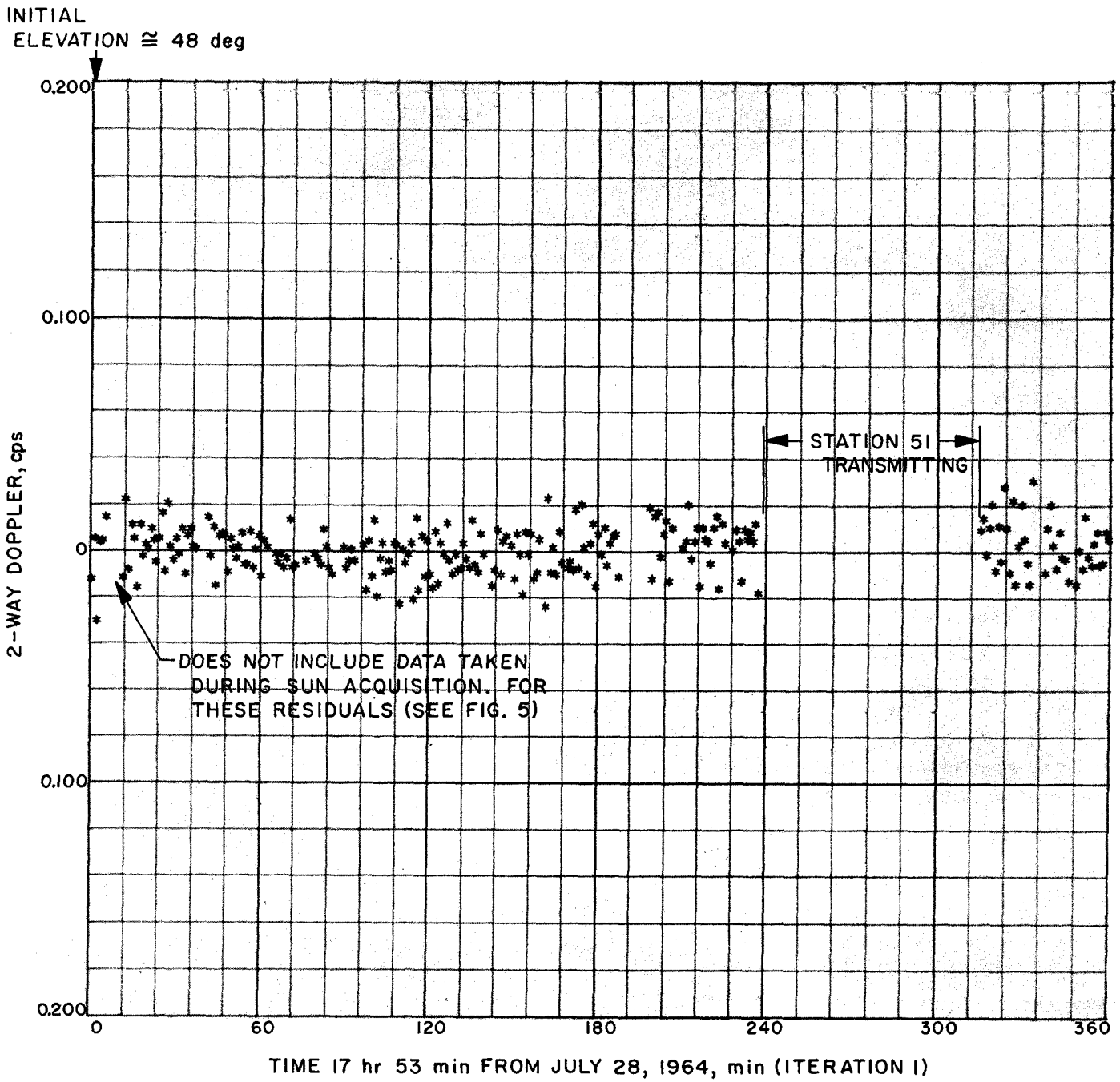


Fig. 9. Station 41 premaneuver pass No. 1 two-way doppler residuals (start 17:53 GMT)

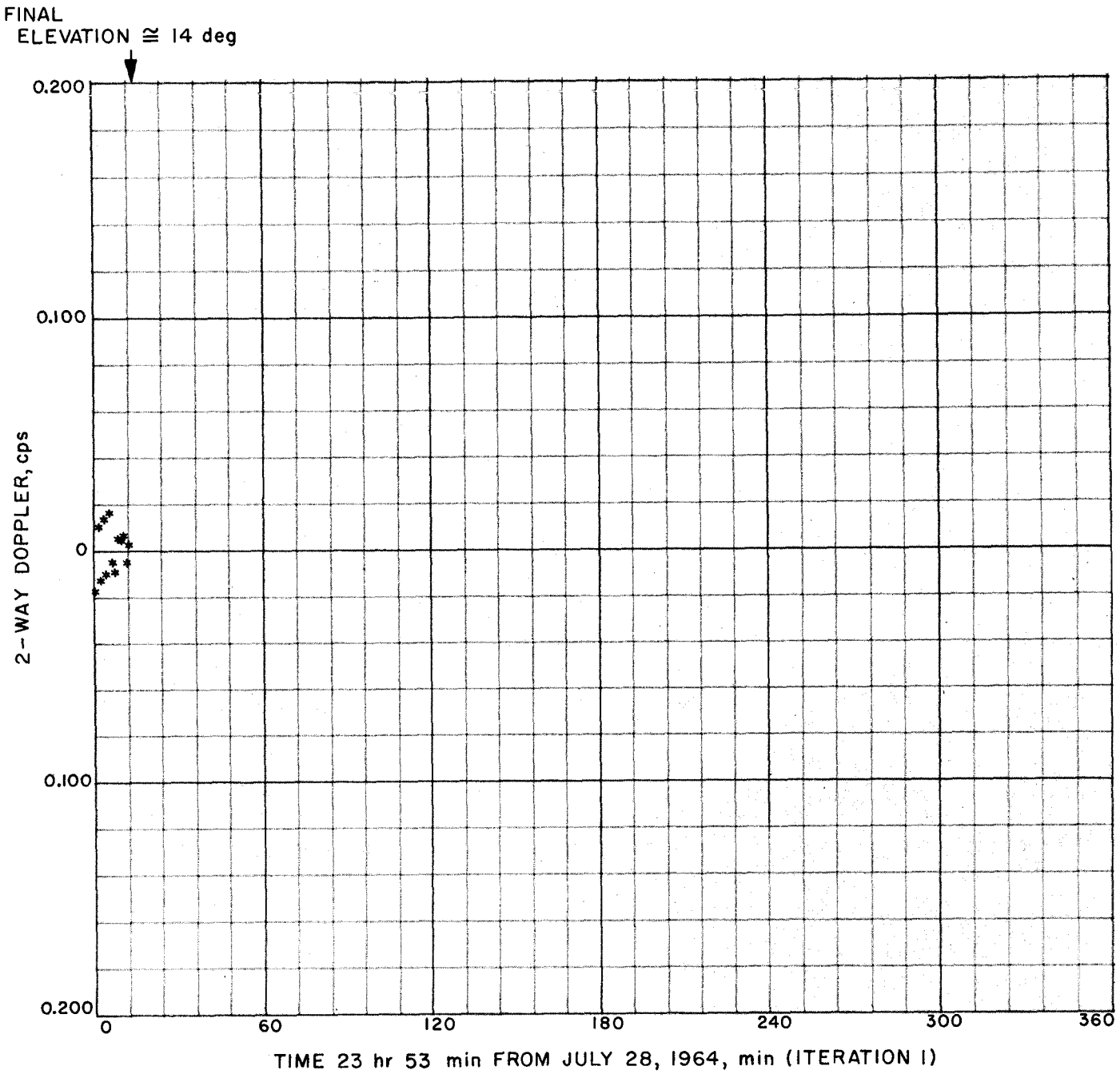


Fig. 10. Station 41 premaneuver pass No. 1 two-way doppler residuals (start 23:53 GMT)

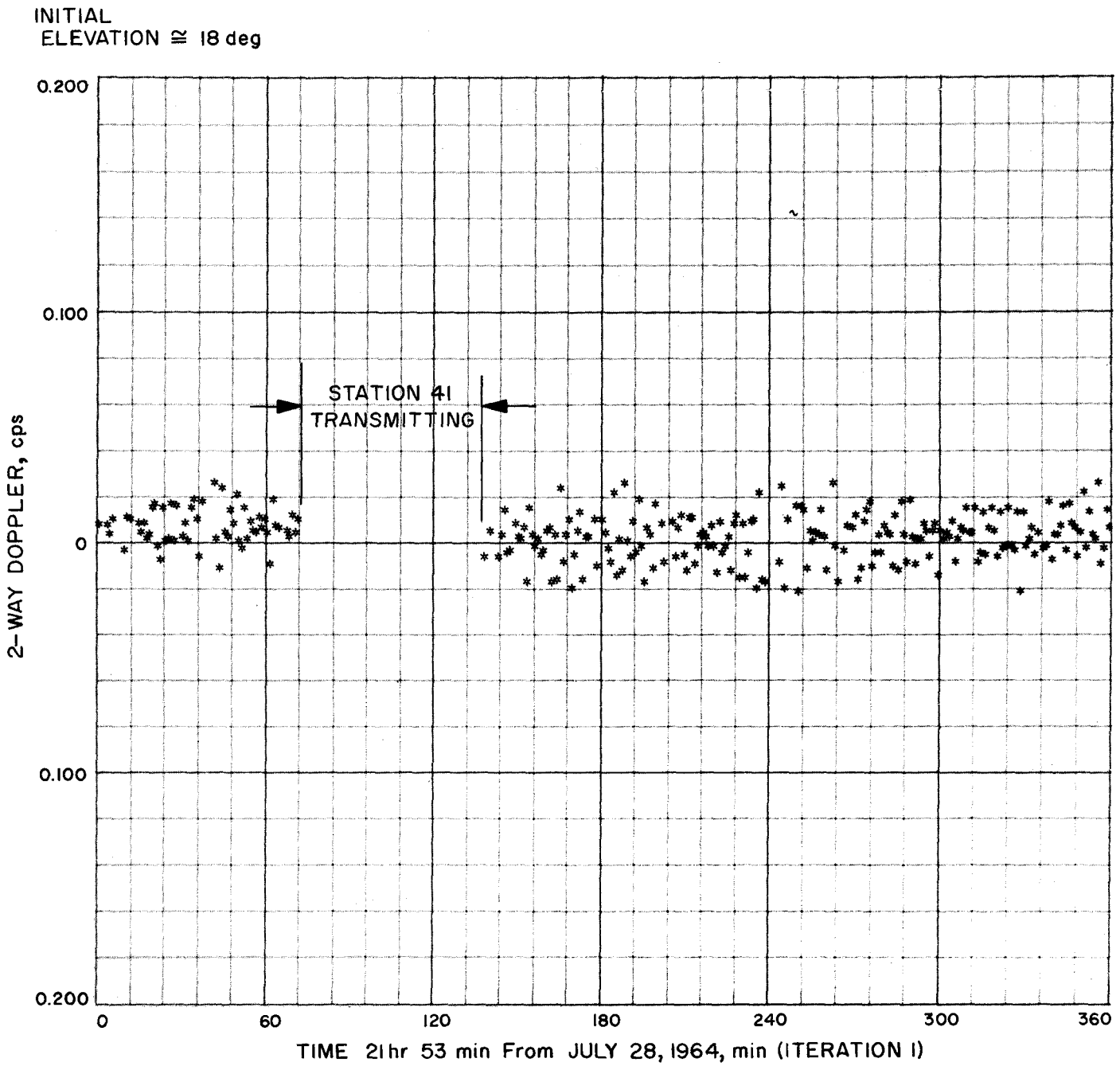


Fig. 11. Station 51 premaneuver pass No. 2 two-way doppler residuals (start 21:53 GMT)

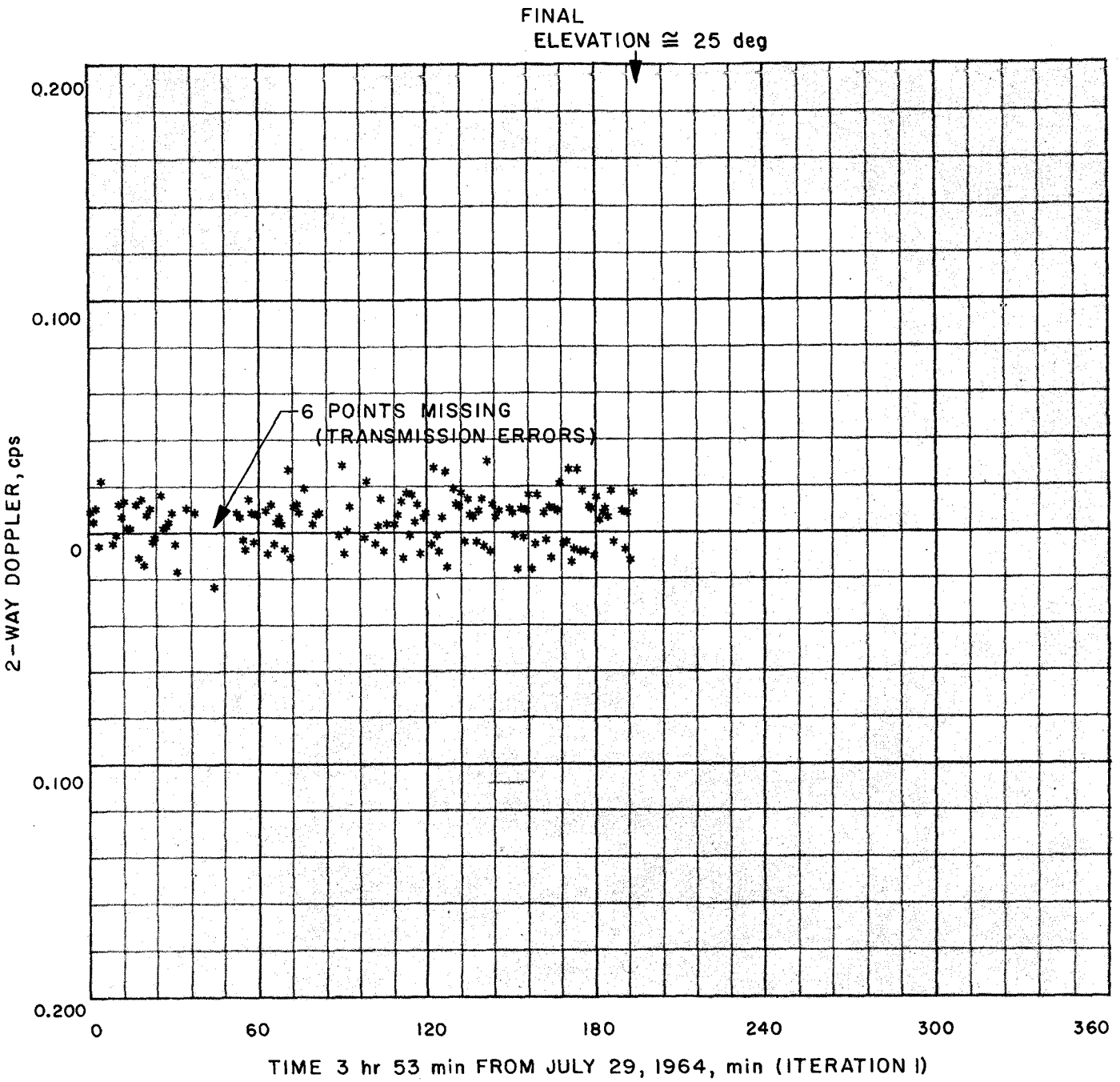


Fig. 12. Station 51 premaneuver pass No. 2 two-way doppler residuals (start 03:53 GMT)

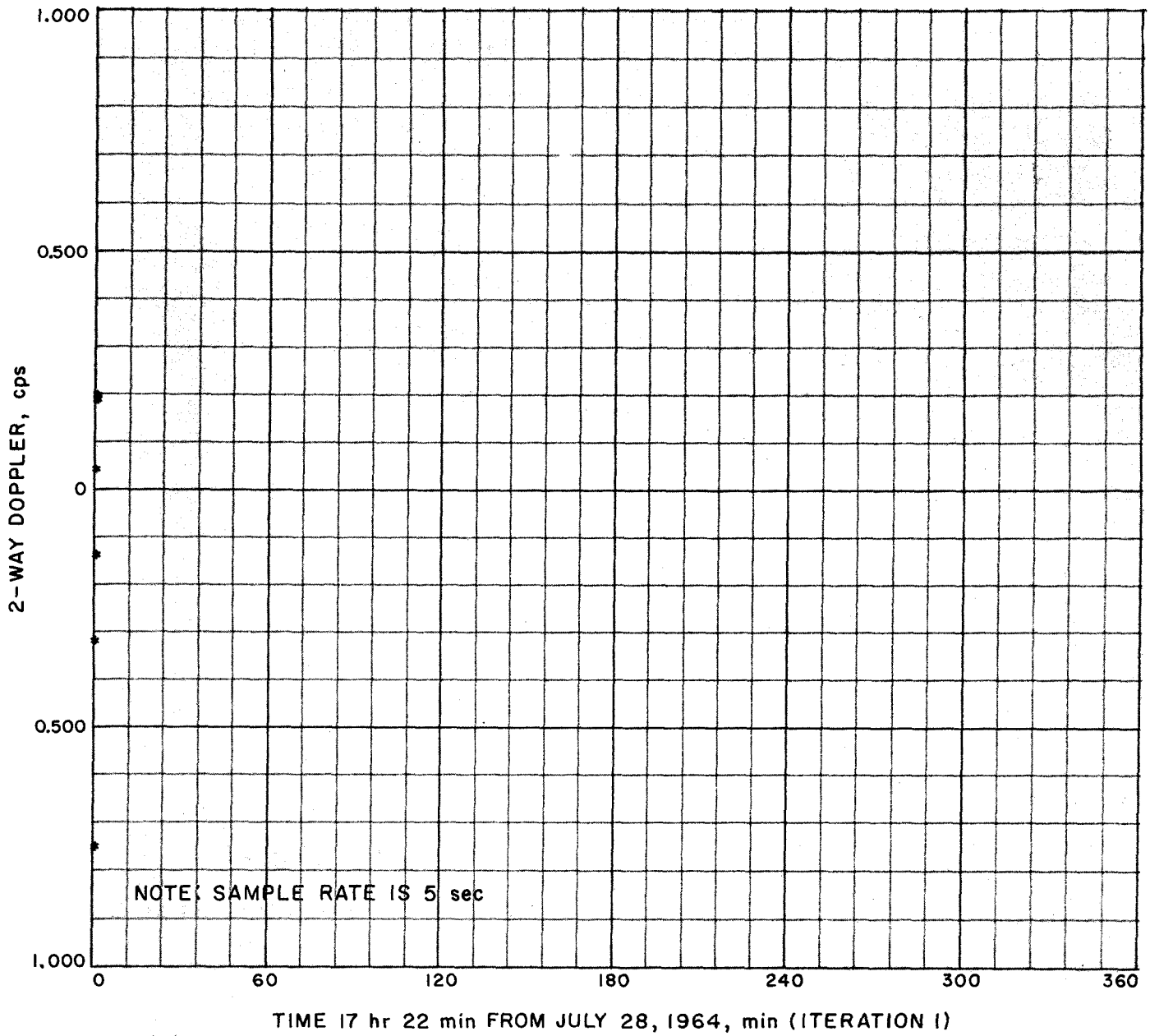


Fig. 13. Station 59 premaneuver pass No. 1 two-way doppler residuals

duced below the input a priority; however, the reduction was not as great as that in *Ranger VI* where it dropped from 10 to 4.25 km³/sec². This is because only 30 sec of usable early data were available for *Ranger VII*; whereas in *Ranger VI*, approximately 2 min of early data were available. Station radius uncertainties were appreciably below the input a priority for all stations except Station 59 where only 5 data points were available.

Numerical values of the estimated parameters are presented in Table 6, column 4. The encounter conditions obtained by mapping the trajectory forward to impact may be seen in Table 7, column 3. For certain parameters, the **B** plane system (defined in Appendix A) is used (Ref. 6). The statistics associated with the encounter parameters are given in Table 8, column 1. In this Table, the semimajor axis *(SMAA)* and the semiminor axis *(SMIA)* define the dispersion ellipse in which impact will occur. *DEL T* is the uncertainty in linearized time of flight along the incoming asymptote. Other terms used in this Table are defined in Appendix G. The correlation matrices at injection and maneuver epochs are presented in Tables 9 and 10.

The conclusions of the premaneuver data analysis are that a good fit was made to all the doppler data, and that the solutions for the physical constants are consistent with presently accepted values.

Table 6. Values of estimated parameters[a]

Estimated parameters (1)	Units (2)	Nominal (3)	Premaneuver — no a priority from postmaneuver (4)	Premaneuver with a priority from postmaneuver (5)	With REM constraint applied to column (5) solution (6)	Postmaneuver — no a priority from premaneuver (7)	Postmaneuver with a priority from postmaneuver (8)	With REM constraint applied to column (8) solution (9)
X^b	km		−4833.5892	−4833.6123	−4833.6187	156675.56	156674.52	156674.59
Y	km		−4206.2476	−4206.2479	−4206.2420	63040.265	63041.633	63041.361
Z	km		−1441.2768	−1441.3998	−1441.4092	8080.9613	8077.6773	8078.2511
DX	m/sec		7.0599831	7.0601073	7.0601102	1434.2599	1434.2616	1434.2624
DY	m/sec		−6.8710693	−6.8712135	−6.8712333	972.56744	972.57020	972.56707
DZ	m/sec		−4.7802324	−4.7797462	−4.7797043	281.16677	281.16151	281.16743
$GM_\oplus$	km³/sec²	398603.20	398601.77	398601.46	398601.36	398602.35	398601.38	398601.28
REM	km	6378.3254	6378.3253	6378.3100	6378.3153	6378.3292	6378.3080	6378.3144
GB	—	0.40	0.40007859	0.38294392	0.38309627	0.39878235	0.39224036	0.39241809
$GM_\mathbb{C}$	km³/sec²	4902.7779	4902.7693	4902.6957	4902.6865	4902.6064	4902.5900	4902.5801
Station 12								
Radius	km	6372.0164	6371.8724	6371.9891	6371.9902	6371.9857	6371.8802	6371.8816
Latitude	deg	35.116540	35.117447	35.118841	35.118834	35.118650	35.117430	35.117422
Longitude	deg	243.19539	243.19473	243.19465	243.19456	243.19417	243.19448	243.19438
Station 41								
Radius	km	6372.6076	6372.5922	6372.5850	6372.5865	6372.6095	6372.6016	6372.6033
Latitude	deg	−31.212360	−31.212461	−31.211878	−31.211866	−31.212158	−31.212264	−31.212250
Longitude	deg	136.88617	136.88810	136.88773	136.88764	136.88736	136.88756	136.88746
Station 51								
Radius	km	6375.5503	6375.4628	6375.4826	6375.4839	6375.4951	6375.4784	6375.4799
Longitude	deg	27.685588	27.685950	27.685600	27.685516	27.685035	27.685339	27.685241
Station 59								
Radius	km	6375.6602	6375.6696	6375.6523	6375.6513	6375.7122	6375.6449	6375.6438
Longitude	deg	27.704570	27.704883	27.705576	27.705564	27.706088	27.705178	27.705165

[a] Maneuver epoch (end of midcourse motor burn) occurred on July 29, 1964 at 10:27:58 GMT.

[b] Space-fixed geocentric equatorial Cartesian coordinates.

Note: Differences between premaneuver and postmaneuver solution values for both position and velocity are a result of the midcourse maneuver. Premaneuver values refer to the time prior to midcourse motor ignition, whereas the postmaneuver values refer to the time after the end of the midcourse motor burn.

Table 7. Impact parameter estimates

Parameter[a] (1)	Units (2)	Premaneuver data only (3)	Postmaneuver data only (4)	Premaneuver as a priority for postmaneuver (5)	postmaneuver as a priority for premaneuver (6)	Best impact location (to date) and time of impact (7)
B•TT	km	−3797.4251	1624.5096	1623.9820	−3801.1085	
B•TT	km	755.19018	800.90869	803.61322	745.15017	
TF[b]	hr	67.393811	50.964119	50.964090	67.395797	
Selenocentric latitude	deg	−12.300271	−10.649078	−10.701728	−12.166415	−10.62[c]
Selenocentric longitude	deg	203.80992	−20.66196	−20.66850	203.40361	−20.59[c]
GMT	hms	12:43:33.722[d]	13:25:48.833[e]	13:25:48.728[e]	12:43:40.875[e]	13:25:48.799[f]

[a] See Appendixes A and G for definitions.
[b] Time of flight for closest approach or impact.
[c] Preliminary values based on analyses of lunar TV photos and Air Force lunar maps.
[d] Based on the nominal lunar radius of 1738.09 km (Ref. 12).
[e] Based on a lunar radius of 1735.6 km.
[f] Time at which Station 12 recorded loss of signal from spacecraft corrected for signal transmit time. Resolution of recording measurements is ± 1 msec.

Table 8. Statistics in the B plane system

Premaneuver data only (1)					Postmaneuver data only (2)					Premaneuver as a priority for postmaneuver (3)				
Standard deviation	Correlation matrix				Standard deviation	Correlation matrix				Standard deviation	Correlation matrix			
		B•R	B•T	TL			B•R	B•T	TL			B•R	B•T	TL
34.6399 km	B•R	1.000	0.361	−0.310	11.556 km	B•R	1.000	−0.889	−0.746	5.707 km	B•R	1.000	−0.977	0.505
20.9206 km	B•T		1.000	−0.795	4.286 km	B•T		1.000	0.363	3.217 km	B•T		1.000	−0.670
14.603 sec	TL			1.000	1.213 sec	TL			1.000	0.196 sec	TL			1.000
SMAA = 35.793 km					SMAA = 12.184 km					SMAA = 6.523 km				
SMIA = 18.880 km					SMIA = 1.860 km					SMIA = 0.605 km				
DEL T = 14.603 sec					DEL T = 1.213 sec					DEL T = 0.196 sec				
θ^b = 107.240 deg					θ^b = 71.296 deg					θ^b = 60.888 deg				

Postmaneuver as a priority for premaneuver (4)					With constraint on REM[a] (lunar scale factor) (5)				
Standard deviation	Correlation matrix				Standard deviation	Correlation matrix			
		B•R	B•T	TL			B•R	B•T	TL
10.391 km	B•R	1.000	−0.782	−0.807	1.578 km	B•R	1.000	−0.467	−0.970
5.184 km	B•T		1.000	0.701	0.410 km	B•T		1.000	0.256
3.042 sec	TL			1.000	0.189 sec	TL			1.000
SMAA = 11.221 km					SMAA = 1.590 km				
SMIA = 2.990 km					SMIA = 0.360 km				
DEL T = 3.042 sec					DEL T = 0.189 sec				
θ^b = 66.950 deg					θ^b = 82.699 deg				

[a] Based on the postmaneuver orbit using premaneuver data as a priority. REM constraint is applied and results converted to selenocentric coordinate system. All other results are in geocentric coordinate system.
[b] θ is measured counterclockwise from lunar equator to SMAA.

Table 9. Correlation matrix on premaneuver data at injection epoch

Standard deviation	Correlation coefficients																		
	X	*Y*	*Z*	*DX*	*DY*	*DZ*	$GM_{\oplus}$	*REM*	*G*	$GM_{\mathbb{C}}$	*RI*(1)	*LO*(1)	*RI*(3)	*LA*(3)	*LO*(3)	*RI*(4)	*LA*(4)	*LO*(4)	*RI*(5)	*LO*(5)
X 0.240 km	1.000	−0.728	0.321	0.379	0.620	−0.240	0.192	0.0	0.0	0.020	0.154	0.489	0.247	0.193	0.937	−0.037	−0.098	0.845	−0.036	0.959
Y 0.318 km		1.000	0.289	−0.620	−0.491	−0.106	−0.384	0.0	0.0	0.004	−0.037	−0.861	0.110	−0.086	−0.642	−0.285	−0.077	−0.336	−0.495	−0.583
Z 0.465 km			1.000	−0.592	0.290	−0.706	0.236	0.0	0.0	0.017	0.318	−0.665	−0.497	0.390	0.417	−0.431	−0.272	0.466	−0.446	0.465
DX 0.588 m/sec				1.000	−0.228	0.782	−0.397	0.0	0.0	−0.003	0.243	0.838	0.541	−0.425	0.239	0.478	0.327	0.258	0.377	0.233
DY 0.679 m/sec					1.000	−0.755	0.527	0.0	−0.001	−0.001	−0.489	0.219	−0.552	0.434	0.668	−0.441	−0.328	0.495	−0.221	0.664
DZ 1.788 m/sec						1.000	−0.565	0.0	0.0	−0.010	0.331	0.459	0.721	−0.567	−0.360	0.592	0.405	−0.261	0.419	−0.373
$GM_{\oplus}$ 6.315 km^3/sec^2							1.000	0.0	0.002	0.020	−0.018	−0.015	−0.742	0.583	0.263	−0.009	−0.009	−0.212	0.467	0.171
REM 0.050 km								1.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	−0.001	0.0	0.0	0.002	0.0
G 0.300 —									1.000	0.0	0.0	0.0	0.0	0.0	−0.002	0.0	0.0	0.001	−0.006	0.0
$GM_{\mathbb{C}}$ 4.99 km^3/sec^2										1.000	0.0	−0.001	0.001	−0.001	−0.018	0.027	0.015	0.016	−0.060	0.015
RI(1) 439 km											1.000	−0.154	0.102	−0.080	0.130	0.362	0.191	0.080	0.331	0.113
LO(1) 0.00420 deg												1.000	0.239	−0.188	0.355	0.387	0.188	0.207	0.435	0.321
RI(3) 0.133 km													1.000	−0.360	−0.285	0.180	0.124	−0.054	−0.065	−0.316
LA(3) 0.00101														1.000	0.225	−0.142	−0.097	0.042	0.051	0.248
LO(3) 0.00348 deg															1.000	−0.173	−0.070	0.826	−0.068	0.958
RI(4) 0.096 km																1.000	−0.041	−0.344	0.582	−0.206
LA(4) 0.0093 deg																	1.000	−0.179	0.435	−0.096
LO(4) 0.00375 deg																		1.000	−0.467	0.906
RI(5) 0.075 km																			1.000	−0.175
LO(5) 0.00346 deg																				1.000

	R	ϕ	λ	*V*	γ	σ
R 0.233 km	1.000	−0.917	0.181	−0.901	0.310	0.589
ϕ 0.00373 deg		1.000	−0.035	0.970	−0.390	−0.727
λ 0.00331 deg			1.000	−0.039	−0.079	−0.039
V 0.243 m/sec				1.000	−0.207	−0.842
γ 0.00227 deg					1.000	−0.269
σ 0.01078 deg						1.000

Table 10. Correlation matrix on premaneuver data at maneuver epoch

Standard deviation	Correlation coefficients																		
	X	Y	Z	DX	DY	DZ	$GM_\oplus$	REM	G	$GM_\mathbb{C}$	RI(1)	LO(1)	RI(3)	LA(3)	LO(3)	RI(4)	LA(4)	LO(4)	RI(5)	LO(5)
X 3.498 km	1.000	−0.942	−0.120	0.941	−0.989	−0.090	0.228	0.0	0.001	0.0	−0.160	−0.637	−0.156	0.123	−0.794	−0.003	−0.066	−0.849	0.065	−0.834
Y 8.838 km		1.000	−0.216	−0.789	0.953	−0.241	−0.021	0.0	−0.001	0.005	0.141	0.453	−0.803	0.065	0.919	−0.172	−0.066	0.932	−0.176	0.958
Z 19.809 km			1.000	−0.407	0.068	0.988	−0.584	0.0	0.0	−0.014	0.067	0.535	0.737	−0.579	−0.417	0.505	0.377	−0.305	0.355	−0.429
DX 0.059 m/sec				1.000	−0.926	−0.372	0.264	0.0	0.004	0.018	−0.230	−0.790	−0.302	0.238	−0.625	−0.235	−0.226	−0.632	−0.189	−0.641
DY 0.082 m/sec					1.000	0.022	−0.174	0.0	−0.005	−0.004	0.275	0.587	0.129	−0.102	0.817	0.019	0.059	0.849	−0.027	0.849
DZ 0.157 m/sec						1.000	−0.545	0.0	−0.001	−0.017	−0.077	0.572	0.709	−0.557	−0.434	0.455	0.350	−0.336	0.337	−0.449
$GM_\oplus$ 6.315 km^3/sec^2							1.000	−0.001	0.002	0.020	0.018	−0.015	−0.742	0.583	0.263	−0.009	−0.009	−0.212	0.467	0.171
REM 0.050 km								1.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.002	0.0
G 0.300									1.000	0.0	0.0	0.0	0.0	0.0	−0.002	0.0	0.0	0.001	−0.006	0.0
$GM_\mathbb{C}$ 5.000 km^3/sec^2										1.000	0.0	−0.001	0.001	−0.001	−0.018	0.027	0.015	0.016	−0.060	0.015
RI(1) 0.439 km											1.000	−0.154	0.102	−0.080	0.130	0.362	0.191	0.080	0.331	0.113
LO(1) 0.004 deg												1.000	0.239	−0.188	0.355	0.387	0.188	0.207	0.435	0.321
RI(3) 0.133 km													1.000	−0.360	−0.285	0.180	0.124	−0.054	−0.065	−0.316
LA(3) 0.001 deg														1.000	0.225	−0.142	−0.097	0.042	0.051	0.248
LO(3) 0.003 deg															1.000	−0.173	−0.070	0.826	−0.068	0.958
RI(4) 0.096 km																1.000	0.041	−0.344	0.582	−0.206
LA(4) 0.001 deg																	1.000	−0.179	0.435	−0.096
LO(4) 0.004 deg																		1.000	−0.467	0.906
RI(5) 0.076 km																			1.000	−0.175
LO(5) 0.003 deg																				1.000

	R	ϕ	λ	V	γ	σ
R 0.219 km	1.000	−0.701	0.132	0.758	−0.647	0.627
ϕ 0.00672 deg		1.000	−0.171	−0.990	0.959	−0.881
λ 0.00320 deg			1.000	0.166	−0.109	0.064
V 0.111 m/sec				1.000	−0.935	0.912
γ 0.00012 deg					1.000	−0.888
σ 0.00025 deg						1.000

E. Postmaneuver Orbit Based on Postmaneuver Tracking Only

Table 11 summarizes the data used for the postflight analysis of the postmaneuver data, and presents the statistics pertaining to these data. The noise level in the postmaneuver data varied between 0.001 and 0.003 m/sec, except for the last entry shown for Station 12. The noise level for this block of data was higher, 0.008 m/sec, since a higher sample rate of 1/10 sec was required due to a higher spacecraft acceleration near lunar encounter. Residual plots for the postmaneuver data may be seen in Figs. 14 through 24. It should be noted that these plots do not pertain to this particular calculation; but, as will be pointed out in the section on combined results, they deviate by an insignificant amount from the residuals of this orbit. The difference in noise characteristics between the two methods of controlling the transmitter reference frequency (i.e., VCO or SYNTHESIZER) may clearly be seen in both the residual plots and the standard deviations of Table 11. For example, in Fig. 14 Station 12 was using the VCO for approximately the first 48 min and then switched to the SYNTHESIZER for the remainder of the view period.

Table 11. Data statistics on postmaneuver data

Station	Number of doppler points	No a priority from premaneuver			With premaneuver data as a priority		With premaneuver data as a priority plus *REM* constraint	
		Standard deviation,[a] cps	Mean, cps	Remarks[b]	Standard deviation, cps	Mean, cps	Standard deviation, cps	Mean, cps
12	31	0.0116	−0.0008	Data taken above 17-deg elevation using VCO	0.0116	−0.0008	0.0115	−0.0003
	341	0.0086	0.0009	Data taken above 17-deg elevation using rubidium frequency standard	0.0085	0.0011	0.0086	0.0013
	42	0.0093	−0.0090	Data taken below 17-deg elevation using rubidium frequency standard	0.0095	−0.0127	0.0096	−0.0128
	62	0.0104	0.0045	Data taken below 17-deg elevation using rubidium frequency standard	0.0104	0.0038	0.0112	0.0040
	564	0.0089	−0.0002	Data taken above 17-deg elevation using rubidium frequency standard	0.0089	−0.0001	0.0089	0.0002
	61	0.0093	−0.0036	Data taken below 17-deg elevation using rubidium frequency standard	0.0092	−0.0024	0.0093	−0.0020
	46	0.0096	0.0017	Data taken below 17-deg elevation using rubidium frequency standard	0.0097	0.0030	0.0097	0.0033
	151	0.0088	0.0001	Data taken above 17-deg elevation using rubidium frequency standard	0.0088	0.0005	0.0088	0.0008
	74	0.0334	−0.0088	Data taken above 17-deg elevation using VCO	0.0334	−0.0069	0.0334	−0.0069
	58[c]	0.0522	−0.0043	Data taken above 17-deg elevation at 10-sec sample rate using VCO	0.0511	0.0048	0.0511	0.0070
41	290	0.0172	0.0003	Data taken above 17-deg elevation using VCO	0.0170	0.0026	0.0170	0.0026
	61	0.0152	−0.0009	Data taken below 17-deg elevation using VCO	0.0151	−0.0027	0.0151	−0.0027
	224	0.0183	−0.0003	Data taken above 17-deg elevation using VCO	0.0183	0.0017	0.0183	0.0020
51	256	0.0141	−0.0009	Data taken above 17-deg elevation using VCO	0.0140	−0.0016	0.0140	−0.0013
	357	0.0155	0.0007	Data taken above 17-deg elevation using VCO	0.0156	−0.0027	0.0156	−0.0019

[a] In the *Ranger VII* station configuration for L-band frequency, 1 counted doppler cycle $\cong$ 0.156 m.
[b] Remarks concerning rubidium frequency standard and VCO refer to method used to provide ground station transmitter reference frequency.
[c] These data taken at a 10-sec sample rate and compressed to 60 sec; all other statistics refer to 60-sec sample rate data.

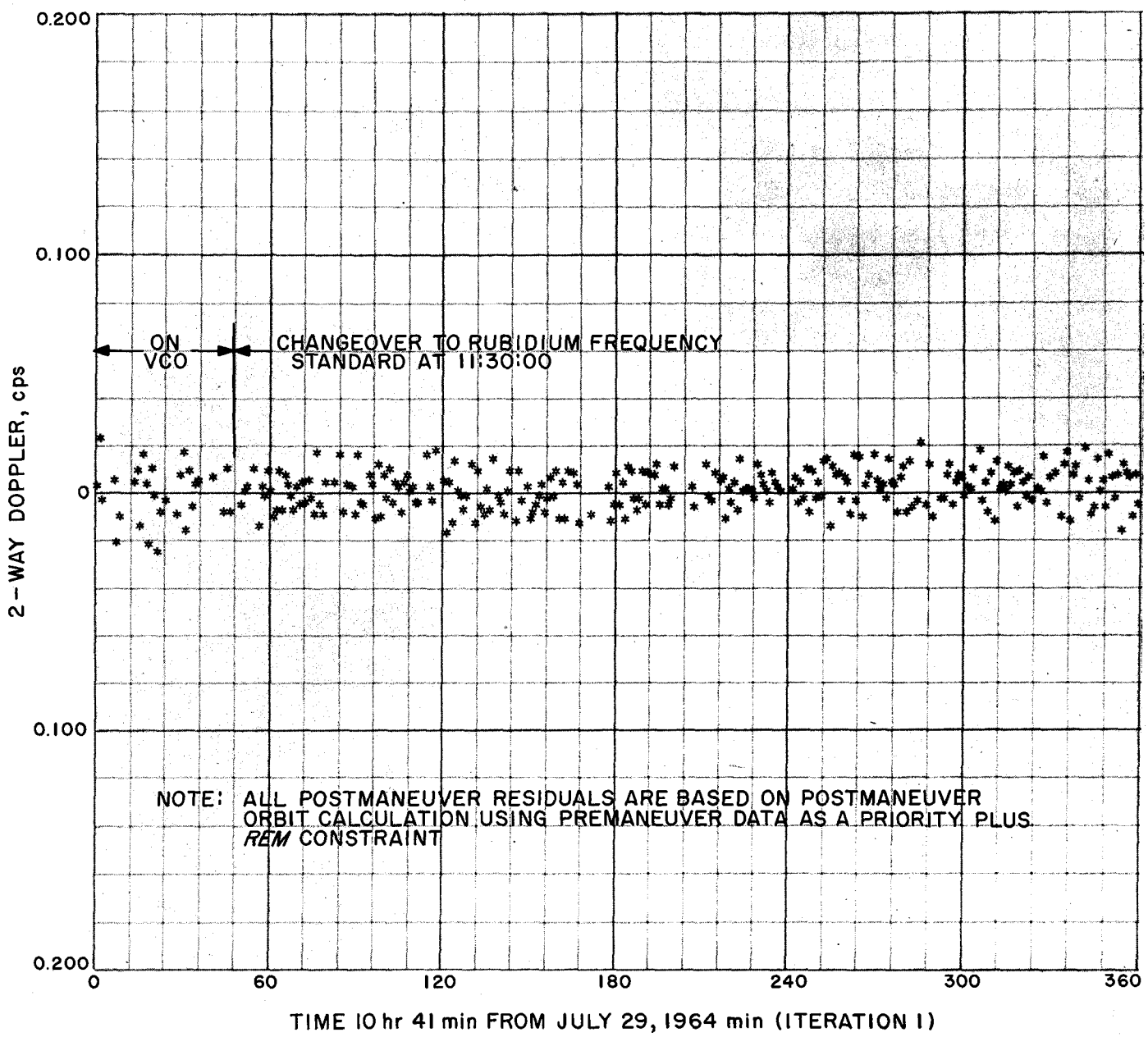


Fig. 14. Station 12 postmaneuver pass No. 1 two-way doppler residuals (start 10:41 GMT)

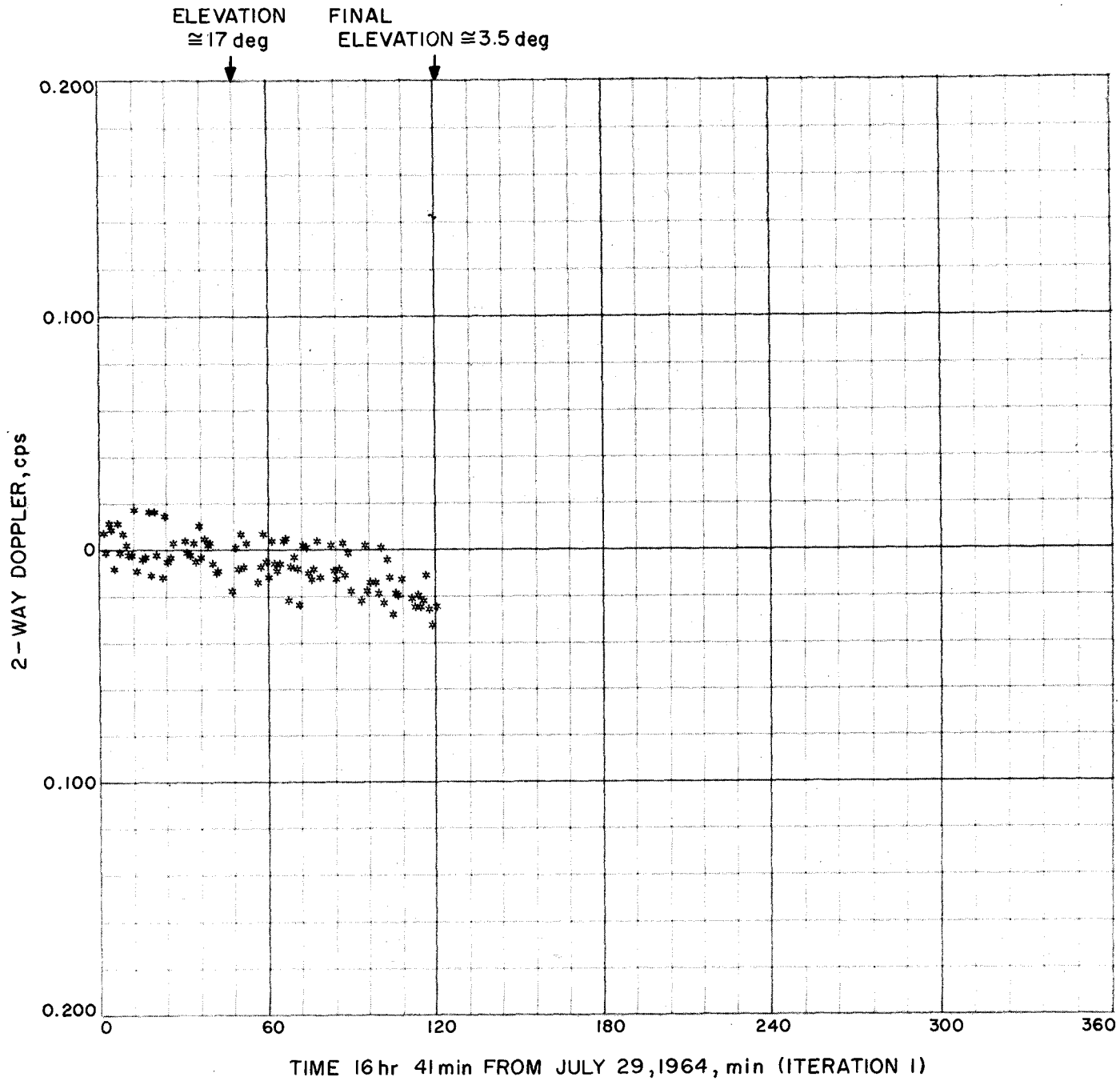


Fig. 15. Station 12 postmaneuver pass No. 1 two-way doppler residuals (start 16:41 GMT)

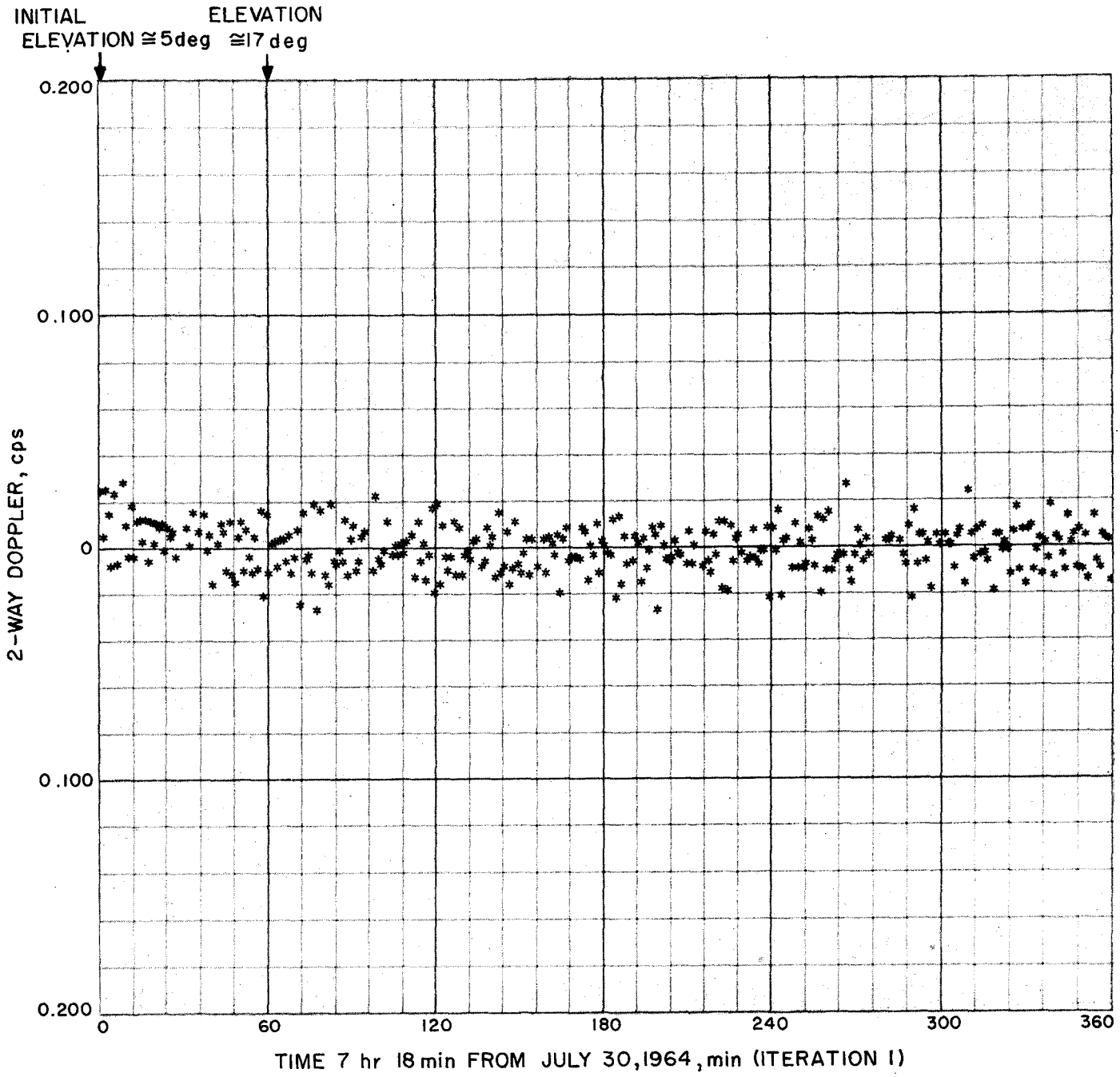


Fig. 16. Station 12 postmaneuver pass No. 2 two-way doppler residuals (start 07:18 GMT)

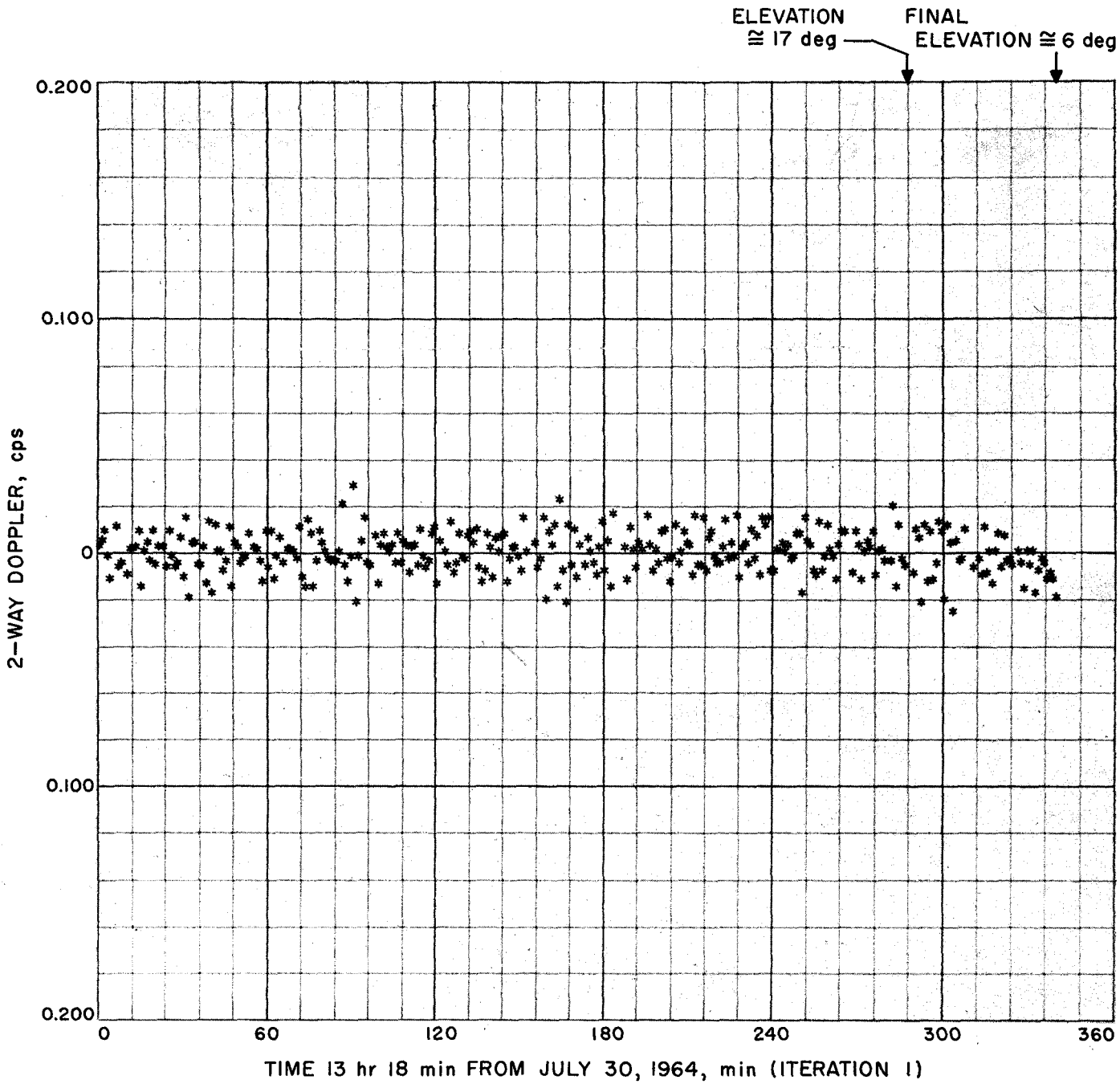


Fig. 17. Station 12 postmaneuver pass No. 2 two-way doppler residuals (start 13:18 GMT)

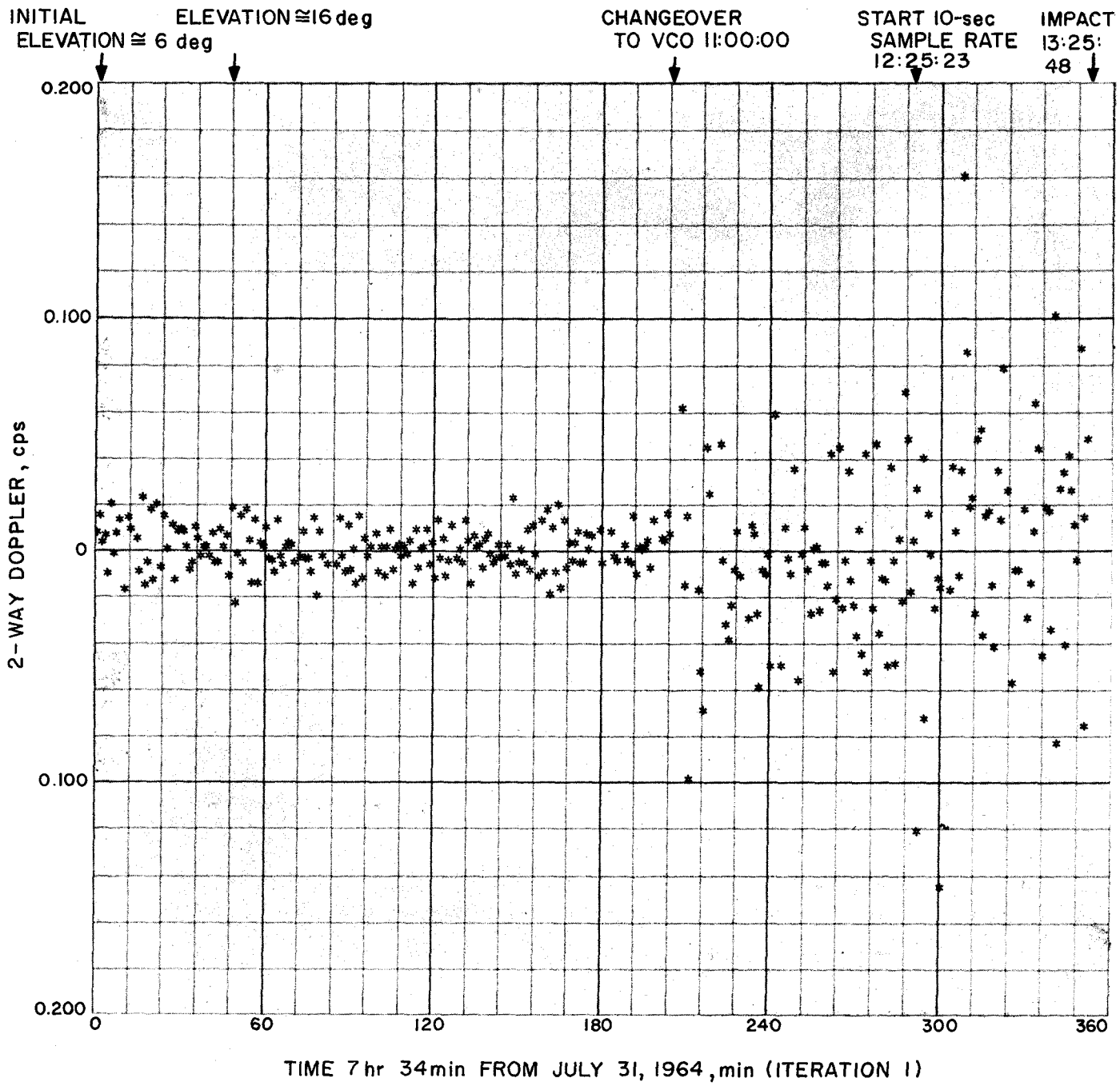


Fig. 18. Station 12 postmaneuver pass No. 3 two-way doppler residuals

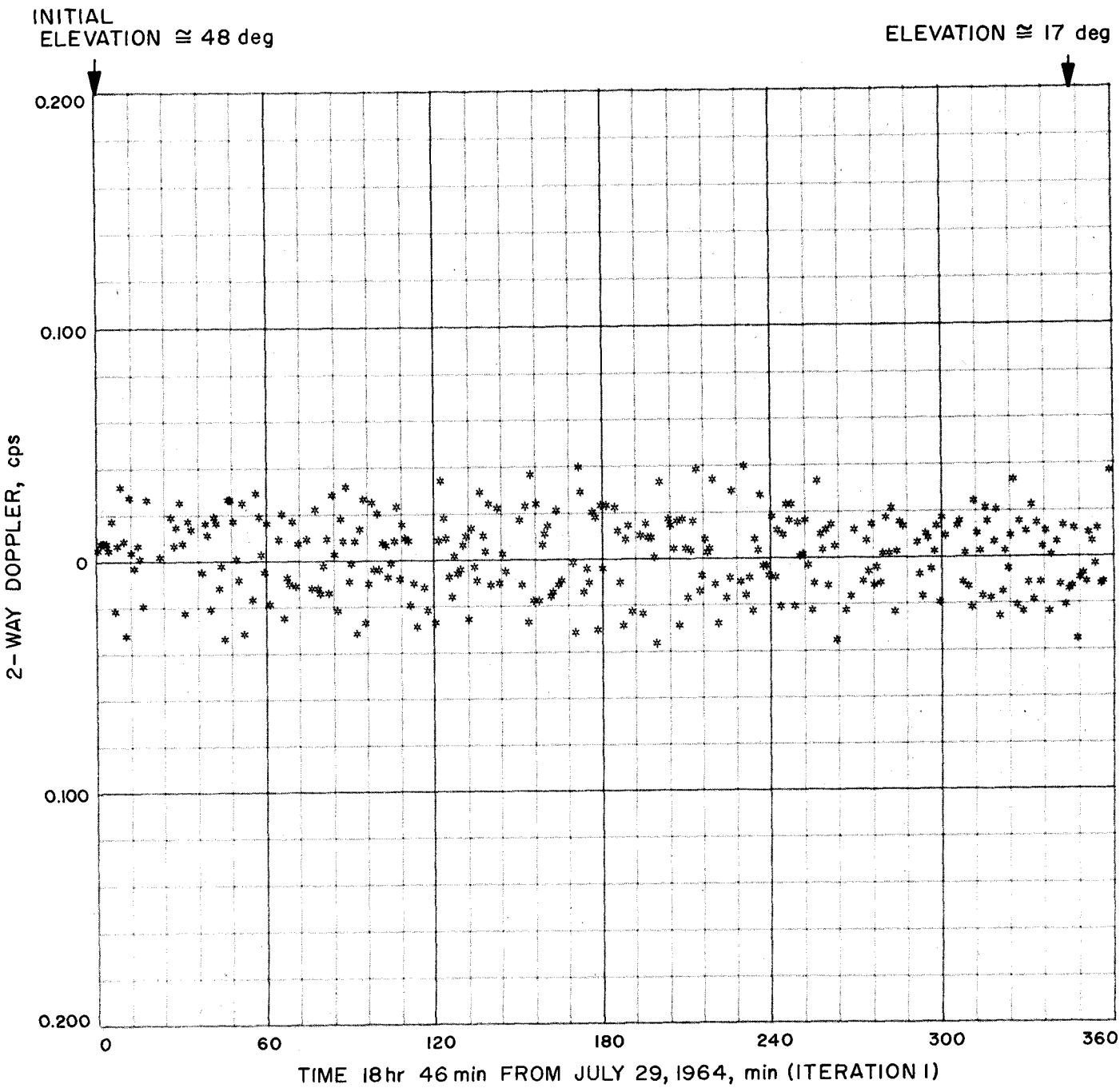


Fig. 19. Station 41 postmaneuver pass No. 1 two-way doppler residuals (start 18:46 GMT)

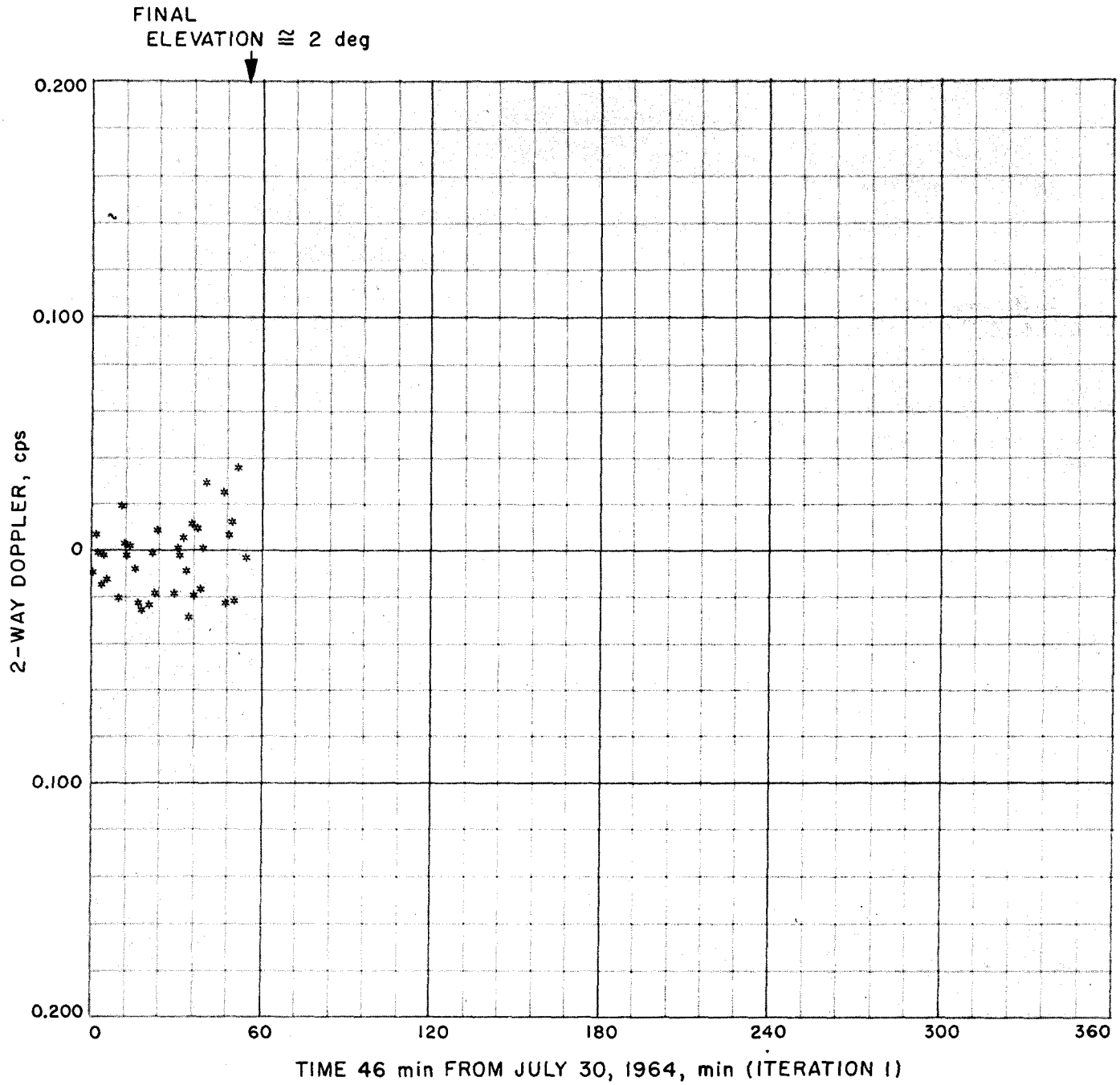


Fig. 20. Station 41 postmaneuver pass No. 1 two-way doppler residuals (start 00:46 GMT)

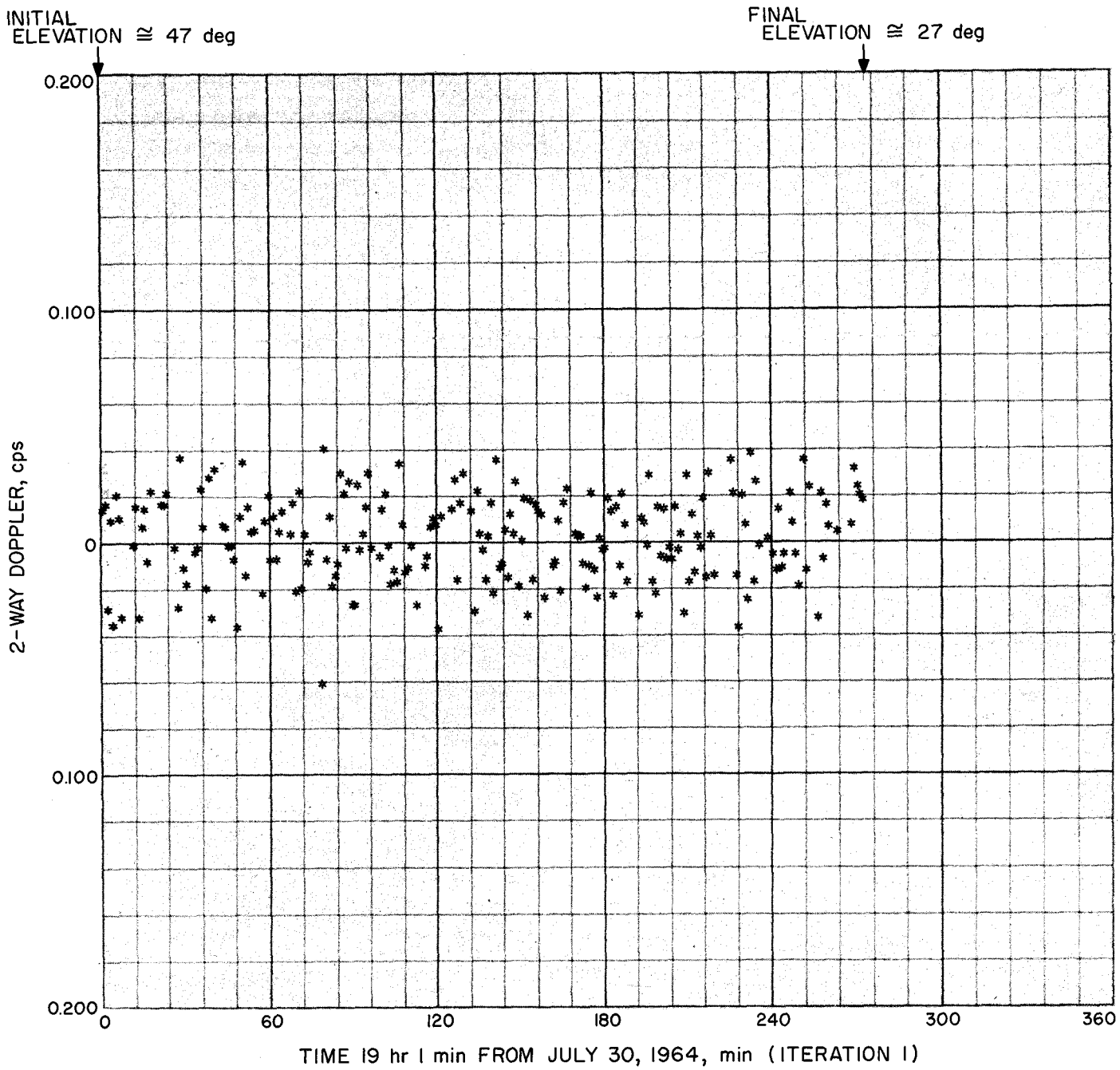


Fig. 21. Station 41 postmaneuver pass No. 2 two-way doppler residuals

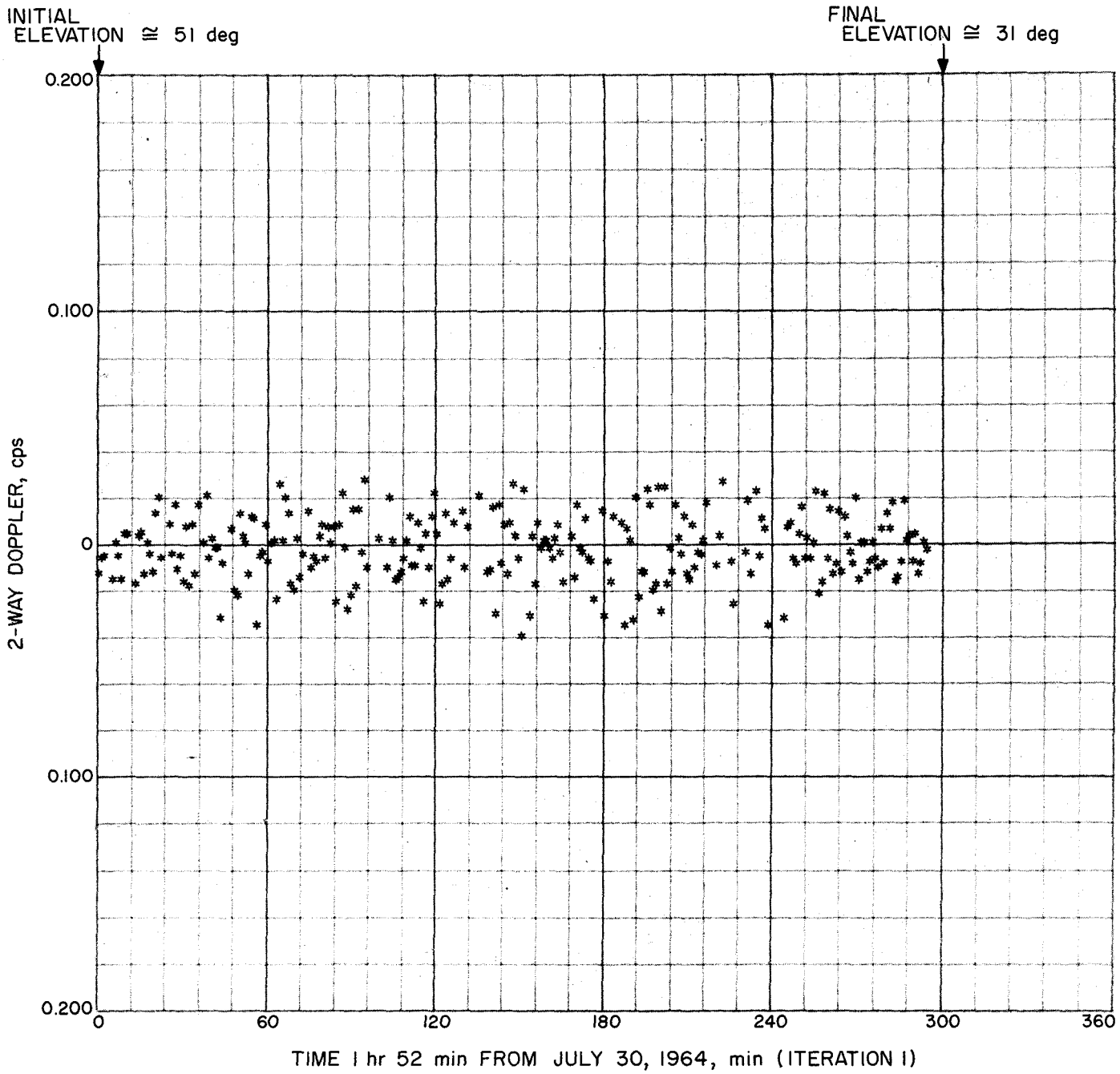


Fig. 22. Station 51 postmaneuver pass No. 1 two-way doppler residuals

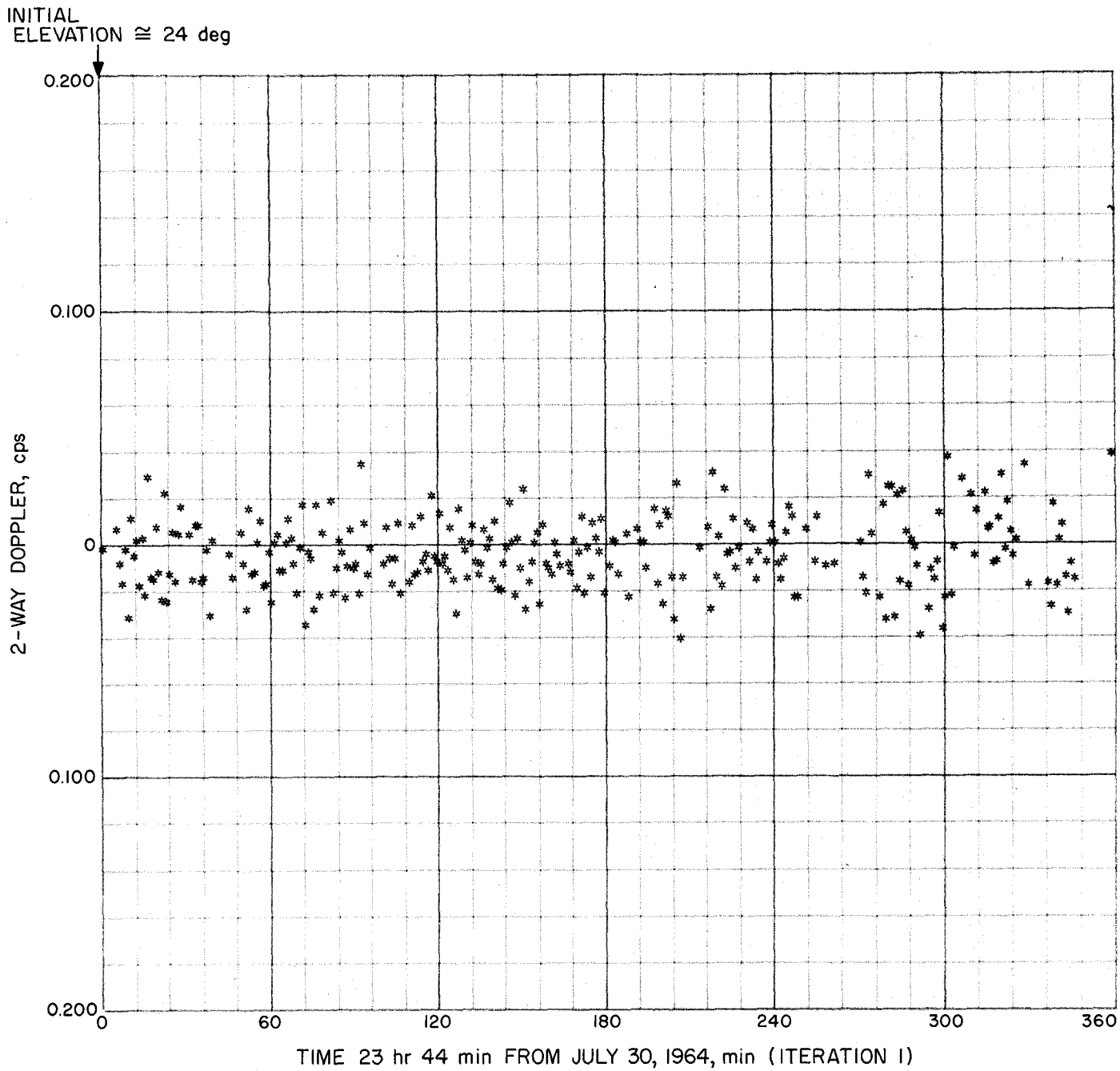


Fig. 23. Station 51 postmaneuver pass No. 2 two-way doppler residuals (start 23:44 GMT)

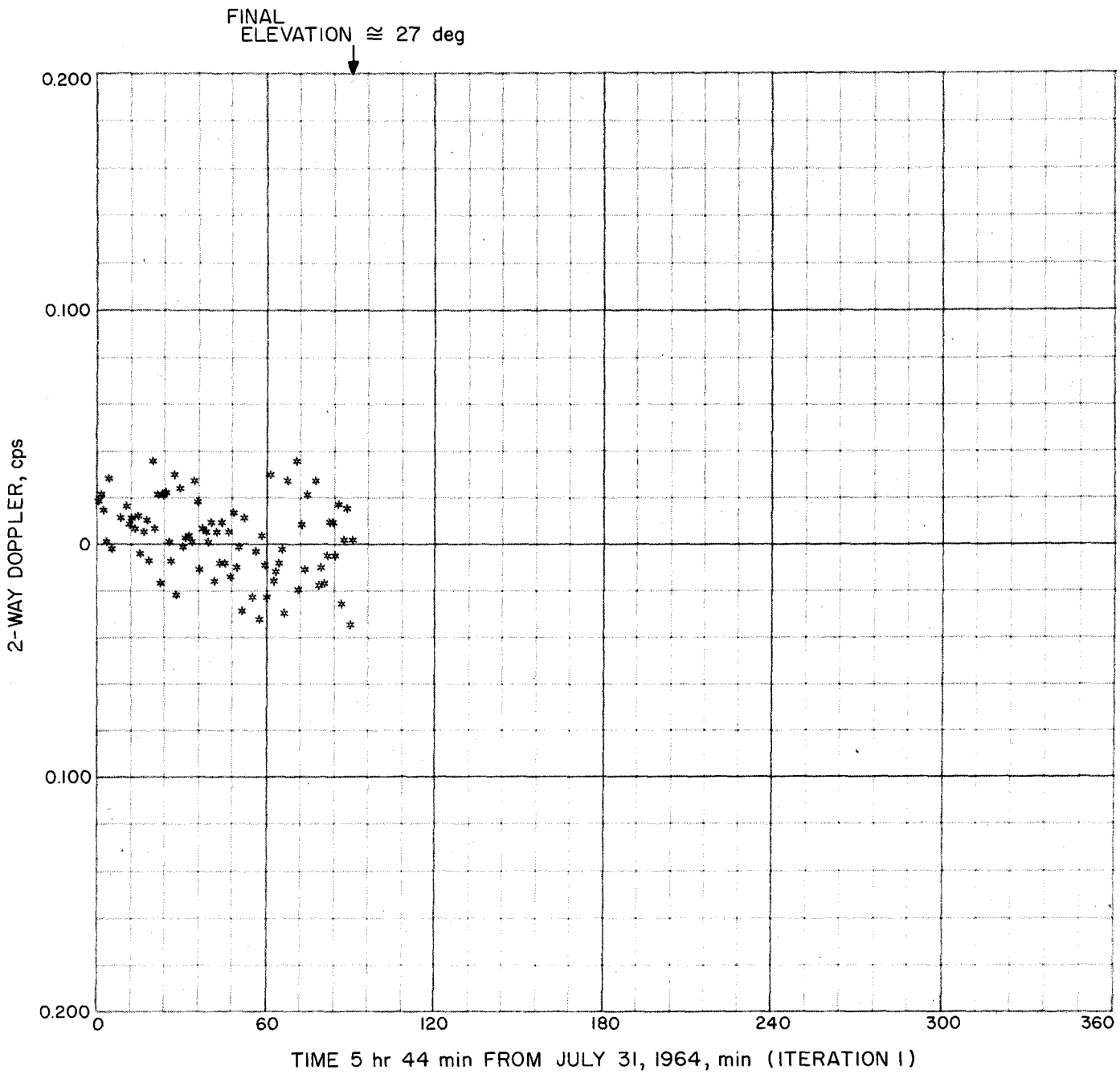


Fig. 24. Station 51 postmaneuver pass No. 2 two-way doppler residuals (start 05:44 GMT)

The noise level for the VCO period was 0.002 m/sec versus a noise level of 0.001 m/sec for the SYNTHESIZER period.

The a priori information for this orbital calculation was the same as that used for the premaneuver study. Statistics associated with the estimated parameters are displayed in Table 5, column 7. The orbital Cartesian uncertainties have been reduced by as much as a factor of 2 from the uncertainties at maneuver epoch based on the premaneuver data only. An even greater reduction may be noted in the statistics at impact epoch. Station location statistics are considered smaller, and the uncertainty in the universal gravitational constant times the mass of the Moon (GM_ζ) has been reduced in magnitude from $\pm$ 4.999 to $\pm$ 0.402 km^3/sec^2. The statistics on the scalar for lunar ephemeris (*REM*) and $GM_\oplus$ indicate a rather weak solution for these parameters.

Numerical values for the estimated parameters are given in Table 6, column 7. A consistency check between the premaneuver and postmaneuver orbits was made using the position vector at maneuver epoch. This was accomplished by correcting the premaneuver position vector by an amount determined by the velocity change due to maneuver execution, and comparing this new value with the postmaneuver value. Results of these computations are shown in Table 12. The solutions are well within the 1-σ uncertainties and assure consistency.

Encounter conditions for this orbit are shown in Table 7, column 4. Of significant interest is the fact that the impact time is based on a lunar radius of 1735.6 km.

Table 12. Positions at maneuver epoch

	Premaneuver only[a]	Postmaneuver only	Postmaneuver–premaneuver
X	156674.70		
ΔX	−0.61		
$X+\Delta Y$	156674.09 $\pm$ 3.5	156675.56 $\pm$ 2.5	1.5 km
Y	63043.938		
ΔY	−0.371		
$Y+\Delta Y$	63043.567 $\pm$ 8.8	63040.365 $\pm$ 3.9	−3.3 km
Z	8073.3712		
ΔZ	−0.152		
$Z+\Delta Z$	8073.2192 $\pm$ 19.8	8080.9613 $\pm$ 8.5	7.7 km

[a]Δ's are the positional changes during maneuver motor burn from the relationship

$$\Delta X = \frac{1}{2} a_x t^2 = \frac{\dot{v}_x t}{2}, \quad \Delta X \rightarrow \Delta Y \rightarrow \Delta Z.$$

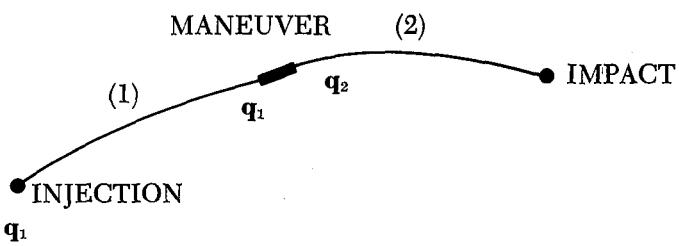
This value was indicated by the results of the *Ranger VI* postflight analysis. During flight operations, using a value based on this, predicted impact was within 0.06 sec of observed impact. It is significant to note that this prediction was made 1 hr before impact. The basis for this lunar radius will be examined in greater detail in a later section. **B** plane statistics associated with the encounter conditions are given in Table 8, column 2. It can be seen that the size of the dispersion ellipse has been considerably reduced from that of the premaneuver orbit. Table 13 shows the correlation matrix of the postmaneuver data at maneuver epoch.

Conclusions based on the analysis of the postmaneuver data are: (1) good fit was made to all data, (2) the solution vector for the physical constants showed a reduction in uncertainties, except for *REM* and $GM_\oplus$ in which a weak solution still exists, and (3) the orbital solution is consistent with that obtained from the premaneuver data.

F. Combined Estimates Based on Premaneuver and Postmaneuver Tracking

1. Method of Combining Premaneuver and Postmaneuver Data

In order to obtain a better estimate on the postmaneuver orbit, the solution vector and its associated covariance matrix from the premaneuver data were used as a priority for the postmaneuver data. The same was done for the premaneuver orbit where the postmaneuver data were used as an a priori covariance matrix for the premaneuver data. The method used for obtaining the premaneuver estimate using postmaneuver data is[4]



$$\Delta \mathbf{q}_1^* = (A_1^T W A_1 + \Lambda_{2_1}^{-1})^{-1} \left[A_1^T W (O_1 - C_1) + \Lambda_{2_1}^{-1} (\mathbf{q}_{2_1} - \mathbf{q}_1)\right]$$

[4]This method was applied by W. L. Sjogren during the postflight analysis of *Ranger VI* tracking data.

Table 13. Correlation matrix on postmaneuver data at maneuver epoch with no a priority

Standard deviation	Correlation coefficients																			
	X	*Y*	*Z*	*DX*	*DY*	*DZ*	$GM_\oplus$	*REM*	*G*	$GM_\mathbb{C}$	*RI*(1)	*LO*(1)	*RI*(3)	*LA*(3)	*LO*(3)	*RI*(4)	*LA*(4)	*LO*(4)	*RI*(5)	*LO*(5)
X 2.5283 km	1.000	0.293	0.390	−0.754	0.510	−0.576	0.803	0.519	−0.022	0.683	0.0	0.0	0.045	−0.026	0.269	0.175	0.074	0.389	−0.083	0.931
Y 3.9455 km		1.000	−0.177	−0.679	0.696	−0.811	0.616	−0.296	−0.010	0.755	0.0	0.0	−0.165	0.094	0.939	−0.157	−0.073	0.929	−0.474	0.932
Z 8.4990 km			1.000	−0.389	−0.355	−0.049	−0.174	0.742	−0.001	0.295	0.0	0.0	0.174	−0.063	−0.324	0.415	0.172	−0.052	0.420	−0.101
DX 0.0161 m/sec				1.000	−0.697	0.921	−0.641	−0.102	−0.014	−0.897	0.0	0.0	0.025	−0.022	−0.670	−0.147	−0.056	−0.817	0.232	−0.805
DY 0.0288 m/sec					1.000	−0.878	0.778	−0.457	0.018	0.619	0.0	0.0	−0.128	0.067	0.824	−0.148	−0.064	0.776	−0.528	0.806
DZ 0.0608 m/sec						1.000	−0.666	0.252	0.026	−0.813	0.0	0.0	0.095	−0.063	−0.846	0.006	0.009	−0.915	0.412	−0.919
$GM_\oplus$ 8.746 km³/sec²							1.000	0.094	0.0	0.702	0.0	0.0	−0.080	0.036	0.624	−0.090	−0.037	0.596	−0.393	0.624
REM 0.0449 km								1.000	−0.001	0.156	0.0	0.0	0.163	−0.079	−0.489	0.300	0.128	−0.316	0.409	−0.346
G 0.3000 —									1.000	0.014	0.0	0.0	0.001	−0.001	−0.004	−0.001	0.0	−0.006	0.005	−0.005
$GM_\mathbb{C}$ 0.4018 km³/sec²										1.000	0.0	0.0	−0.037	0.036	0.703	0.080	0.028	0.817	−0.262	0.807
RI(1) 0.452 km											1.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LO(1) 0.00498 deg												1.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RI(3) 0.059 km													1.000	0.929	−0.171	0.082	0.036	−0.137	0.122	−0.144
LA(3) 0.00074 deg														1.000	0.095	−0.041	−0.018	0.074	−0.061	0.078
LO(3) 0.00098 deg															1.000	−0.174	−0.080	0.938	−0.532	0.953
RI(4) 0.064 km																1.000	−0.629	−0.109	0.196	−0.085
LA(4) 0.00079 deg																	1.000	−0.046	0.084	−0.043
LO(4) 0.00107 deg																		1.000	−0.441	0.966
RI(5) 0.044 km																			1.000	−0.485
LO(5) 0.0010 deg																				1.000

	R	ϕ	λ	*V*	γ	σ
R 3.221 km	1.000	0.313	0.432	0.982	−0.994	−0.725
ϕ 0.00287 deg		1.000	−0.300	0.178	−0.226	−0.808
λ 0.00119 deg			1.000	0.574	−0.495	−0.175
V 0.218 m/sec				1.000	−0.993	−0.631
γ 0.00016 deg					1.000	0.666
σ 0.00052 deg						1.000

and

$$\mathbf{q}_1^* = \mathbf{q}_{2_1} + \Delta\mathbf{q}_1^* = \text{best maneuver estimate}$$

where

$$\Lambda_{2_1} = U(\Lambda_2 + \Lambda_M)U^T$$

$$\Lambda_2 = (A_2^T W A_2 + \tilde{\Lambda}^{-1})^{-1}$$

U = matrix which maps $(\mathbf{q}_2 - \mathbf{q}_m)$ to injection

$\tilde{\Lambda}$ = a priori covariance

$$A_2 = \frac{\partial \text{ observable in block (2) (postmaneuver)}}{\partial \text{ estimated parameter}}$$

$$\mathbf{q}_{2_1} = U(\mathbf{q}_2 - \mathbf{q}_m)$$

$\mathbf{q}_2$ = solution vector of estimated parameters from block (2) data only

$\Lambda_2 = (A_2^T W A_2)^{-1}$ = covariance on estimated parameters from block (2) data only

W = diagonal weighting matrix on observables

$O - C$ = residuals (i.e., observed data minus calculated data)

Λ_M = covariance on maneuver (diagonal purposely set to a very pessimistic value of 100 m/sec)

$\mathbf{q}_m$ = nominal inflight maneuver estimate

The following expression for the postmaneuver estimate using premaneuver data is very similar

$$\Delta\mathbf{q}_2^* = (A_2^T W A_2 + \Lambda_{1_2}^{-1})^{-1}\left[A_2^T W (O_2 - C_2) + \Lambda_{1_2}^{-1}(\mathbf{q}_{1_2} - \mathbf{q}_2)\right]$$

$$\text{and } \mathbf{q}_2^* = \Delta\mathbf{q}_2^* + \mathbf{q}_m$$

2. Results of Combining Premaneuver and Postmaneuver Data

The estimated parameter statistics based on combining the postmaneuver data with the premaneuver estimate are given in Table 5, column 5. It may be seen that the uncertainties have been significantly reduced from those based on the premaneuver data only. A stronger solution for $GM_\oplus$, $GM_\mathbb{C}$, and *REM* is now indicated. Numerical values for the estimated parameters are shown in Table 6, column 6. The differences between the solution vectors of the premaneuver-data-only orbit and this orbit are well within the uncertainties seen in column 5 of Table 5, except for radius and latitude of Station 12. It may be seen in Table 14 that a high correlation (0.966) exists between the radius *RI*(3) and latitude *LA*(3) of Station 12. A comparison based on computing the term R cos (latitude) for the two solutions shows a difference of 6.3 m. From this it may be concluded that the two solutions for Station 12 location are consistent. Encounter conditions seen in Table 7, column 6, indicate a predicted impact time difference of 7.15 sec between the two premaneuver estimates. This is accounted for by the fact that a different lunar radius was used for the two calculations. That is, without correction, the spacecraft would impact the dark side of the Moon on a grazing trajectory; therefore, the difference in lunar radius is significant. A comparison of the **B** plane statistics (Table 7, columns 1 and 4) reveals a significant reduction in the statistics and the dispersion ellipse for the combined estimate. The correlation matrix for the premaneuver data at maneuver epoch is given in Table 15. The trajectory and the ODP printout, including the data weights and the doppler residuals, for this orbital estimate may be seen in Appendixes B, C, E, and F. Explanations of the printout forms are given in Appendixes D and G.

For the postmaneuver orbit, using premaneuver data as a priority, the estimated parameter statistics (Table 5, column 8) reveal a significant reduction in the uncertainties when compared with the orbit obtained from postmaneuver data only. It may be seen that the uncertainties on the physical constants and the station locations are the same as those obtained by using the postmaneuver data as a priority for the premaneuver estimate. This indicates that the method of combining the two blocks of data was consistent. The differences between the parameter values of the orbit based on postmaneuver data only and this orbit (Table 6, columns 7 and 8) are again well within the uncertainties except for Station 12. The explanation for this is the same as in the preceding paragraph. Encounter conditions (Table 7, column 5) show good agreement with those obtained from the postmaneuver data only, and the **B** plane statistics (Table 8, column 3) are reduced by almost a factor of 2. The correlation matrix from this orbital calculation at maneuver epoch is given in Table 16. The trajectory and the ODP printout, including the data weights and the doppler residuals, for this orbital estimate may be seen in Appendixes C and F, respectively.

The differences between the estimated physical constants and station locations, using the r cos ϕ relationship for Station 12, for the above orbits are well within the respective uncertainties. This, plus the fact that the statistics for these orbits were identical, gives assurance that a better estimate has been obtained for both the premaneuver and postmaneuver orbit. In addition, $GM_\oplus$ and $GM_\mathbb{C}$ are measured at least a factor of 2 better than each separate estimate, and *REM* by a factor of 1.25.

Table 14. Correlation matrix on premaneuver data at injection epoch with postmaneuver data as a priority

Standard deviation	Correlation coefficients																		
	X	Y	Z	DX	DY	DZ	$GM_\oplus$	REM	G	$GM_\mathbb{C}$	RI(1)	LO(1)	RI(3)	LA(3)	LO(3)	RI(4)	LA(4)	LO(4)	RI(5)	LO(5)
X 0.068 km	1.000	−0.849	0.030	0.401	0.497	−0.423	0.539	−0.541	0.025	0.367	−0.524	0.607	−0.087	0.046	0.642	0.225	−0.436	0.583	−0.204	0.621
Y 0.109 km		1.000	0.306	−0.375	−0.671	0.496	−0.667	0.224	−0.037	−0.286	0.237	−0.796	0.061	−0.048	−0.378	−0.197	0.525	−0.294	0.154	−0.369
Z 0.150 km			1.000	−0.021	−0.591	0.400	0.151	−0.415	−0.038	0.047	0.806	−0.758	−0.048	0.011	0.394	−0.083	0.173	0.337	0.252	0.350
DX 0.076 m/sec				1.000	−0.268	0.539	0.002	0.286	0.109	0.366	0.327	0.286	0.091	0.036	−0.154	0.524	−0.343	−0.118	0.280	−0.118
DY 0.323 m/sec					1.000	−0.930	0.337	−0.358	0.003	0.197	−0.757	0.768	−0.083	0.035	0.432	−0.178	−0.218	0.412	−0.526	0.447
DZ 0.463 m/sec						1.000	−0.379	0.556	0.033	−0.115	0.658	−0.519	0.123	−0.026	−0.584	0.351	0.057	−0.542	0.545	−0.575
$GM_\oplus$ 1.532 km^3/sec^2							1.000	−0.211	0.014	0.053	0.114	0.262	−0.108	0.014	0.333	−0.227	−0.067	0.161	0.143	0.262
REM 0.036 km								1.000	0.009	−0.353	0.003	0.007	0.114	−0.056	−0.896	0.141	0.093	−0.882	0.394	−0.888
G 0.300 —									1.000	0.089	−0.006	0.048	0.002	0.0	0.016	0.006	0.008	0.023	0.011	0.025
$GM_\mathbb{C}$ 0.167 km^3/sec^2										1.000	−0.006	0.194	0.008	0.037	0.475	−0.039	−0.023	0.516	−0.128	0.516
RI(1) 0.320 km											1.000	−0.695	0.018	0.004	0.008	0.158	0.019	−0.044	0.468	−0.025
LO(1) 0.00148 deg												1.000	−0.016	0.021	0.083	0.204	−0.416	0.082	−0.298	0.102
RI(3) 0.058 km													1.000	0.966	−0.105	0.035	0.011	−0.099	0.043	−0.118
LA(3) 0.00074 deg														1.000	0.072	−0.015	−0.013	0.064	−0.025	0.062
LO(3) 0.00062 deg															1.000	−0.163	−0.098	0.927	−0.361	0.957
RI(4) 0.057 km																1.000	−0.770	−0.210	0.077	−0.141
LA(4) 0.00077 deg																	1.000	−0.094	0.096	−0.108
LO(4) 0.00064 deg																		1.000	−0.412	0.934
RI(5) 0.025 km																			1.000	−0.396
LO(5) 0.00062 deg																				1.000

	R	ϕ	λ	V	γ	σ
R 0.063 km	1.000	−0.855	0.437	−0.890	0.680	−0.366
ϕ 0.00123 deg		1.000	−0.167	0.898	−0.814	0.288
λ 0.00109 deg			1.000	−0.126	0.131	−0.513
V 0.052 m/sec				1.000	−0.601	0.029
γ 0.00155 deg					1.000	−0.702
σ 0.00270 deg						1.000

Table 15. Correlation matrix on premaneuver data at maneuver epoch with postmaneuver data as a priority

Standard deviation	Correlation coefficients																			
	X	*Y*	*Z*	*DX*	*DY*	*DZ*	$GM_{\oplus}$	*REM*	*G*	$GM_{\mathbb{C}}$	*RI*(1)	*LO*(1)	*RI*(3)	*LA*(3)	*LO*(3)	*RI*(4)	*LA*(4)	*LO*(4)	*RI*(5)	*LO*(5)
X 0.550 km	1.000	−0.940	0.580	0.858	−0.853	0.445	−0.136	0.694	−0.049	−0.653	−0.069	−0.164	0.064	−0.090	−0.838	0.136	0.105	−0.864	0.386	−0.896
Y 1.887 km		1.000	−0.805	−0.741	0.895	−0.657	0.427	−0.765	0.018	0.540	−0.023	0.199	−0.099	0.084	0.906	−0.205	−0.118	0.873	−0.343	0.920
Z 3.675 km			1.000	0.284	−0.667	0.868	−0.678	0.801	0.053	−0.145	−0.042	−0.102	0.159	−0.034	−0.841	0.237	0.116	−0.722	0.249	−0.784
DX 0.007 m/sec				1.000	−0.871	0.368	−0.066	0.415	−0.074	−0.734	−0.272	0.016	0.007	−0.089	−0.601	−0.022	0.083	−0.638	0.084	−0.676
DY 0.016 m/sec					1.000	−0.745	0.386	−0.636	0.010	0.559	0.371	−0.058	−0.062	0.087	0.792	−0.063	−0.128	0.757	−0.092	0.804
DZ 0.033 m/sec						1.000	−0.604	0.703	0.046	−0.114	−0.492	0.250	0.128	−0.027	−0.729	0.104	0.078	−0.607	−0.022	−0.662
$GM_{\oplus}$ 1.53 km^3/sec^2							1.000	−0.211	0.014	0.053	0.114	0.262	−0.108	0.014	0.333	−0.227	−0.067	0.161	0.143	0.262
REM 0.036 km								1.000	0.009	−0.353	0.003	0.007	0.114	−0.056	−0.896	0.141	0.093	−0.882	0.394	−0.888
G 0.300 —									1.000	0.089	−0.006	0.048	0.002	0.0	0.016	0.006	0.008	0.023	0.011	0.025
$GM_{\mathbb{C}}$ 0.167 km^3/sec^2										1.000	−0.006	0.194	0.008	0.037	0.475	−0.039	−0.023	0.516	−0.128	0.516
RI(1) 0.320 km											1.000	−0.695	0.018	0.004	0.008	0.158	0.019	−0.044	0.468	−0.025
LO(1) 0.0014 deg												1.000	−0.016	0.021	0.083	0.204	−0.416	0.082	−0.298	0.102
RI(3) 0.058 km													1.000	0.966	−0.105	0.035	0.011	−0.099	0.043	−0.118
LA(3) 0.00074 deg														1.000	0.072	−0.015	−0.013	0.064	−0.025	0.062
LO(3) 0.00062 deg															1.000	−0.163	−0.098	0.927	−0.361	0.957
RI(4) 0.057 km																1.000	−0.770	−0.210	0.077	−0.141
LA(4) 0.00077 deg																	1.000	−0.094	0.096	−0.108
LO(4) 0.00064 deg																		1.000	−0.412	0.934
RI(5) 0.025 km																			1.000	−0.396
LO(5) 0.00062 deg																				1.000

	R	ϕ	λ	*V*	γ	σ
R 0.128 km	1.000	−0.738	0.622	0.820	−0.700	0.342
ϕ 0.00125 deg		1.000	−0.786	−0.938	0.951	−0.476
λ 0.00066 deg			1.000	0.787	−0.643	0.451
V 0.026 m/sec				1.000	−0.911	0.695
γ 0.00002 deg					1.000	−0.538
σ 0.00009 deg						1.000

Table 16. Correlation matrix on postmaneuver data at maneuver epoch with premaneuver data as a priority

Standard deviation	Correlation coefficients																			
	X	Y	Z	DX	DY	DZ	$GM_\oplus$	REM	G	$GM_\mathbb{C}$	RI(1)	LO(1)	RI(3)	LA(3)	LO(3)	RI(4)	LA(4)	LO(4)	RI(5)	LO(5)
X 0.554 km	1.000	−0.941	0.579	0.633	−0.570	0.633	−0.136	0.696	−0.047	−0.658	0.080	−0.176	0.064	−0.089	−0.840	0.141	0.100	−0.866	0.389	−0.897
Y 1.891 km		1.000	−0.802	−0.612	0.670	−0.712	0.425	−0.763	0.018	0.550	−0.028	0.208	−0.098	0.084	0.906	−0.205	−0.115	0.873	−0.340	0.920
Z 3.616 km			1.000	0.558	−0.784	0.726	−0.680	0.796	0.053	−0.157	−0.054	−0.104	0.157	−0.034	−0.838	0.229	0.117	−0.718	0.235	−0.781
DX 0.006 m/sec				1.000	−0.913	0.936	0.075	0.934	−0.113	−0.475	0.013	0.060	0.070	−0.045	−0.791	0.061	0.057	−0.827	0.394	−0.793
DY 0.018 M/sec					1.000	−0.978	0.259	−0.978	0.037	0.299	0.015	−0.010	−0.108	0.050	0.809	−0.140	−0.086	0.794	−0.341	0.797
DZ 0.035 m/sec						1.000	−0.127	0.984	0.010	−0.330	0.017	0.013	0.093	−0.066	−0.826	0.126	0.087	−0.844	0.400	−0.837
$GM_\oplus$ 1.530 km³/sec²							1.000	−0.208	0.014	0.056	0.116	0.264	−0.107	0.013	0.330	−0.224	−0.066	0.159	0.148	0.260
REM 0.036 km								1.000	0.009	−0.366	0.002	0.0	0.112	−0.056	−0.895	0.137	0.092	−0.881	0.388	−0.887
G 0.300									1.000	0.088	−0.005	0.047	0.002	0.0	0.016	0.006	0.008	0.023	0.011	0.024
$GM_\mathbb{C}$ 0.167 km³/sec²										1.000	−0.013	0.197	0.006	0.038	0.486	−0.045	−0.022	0.526	−0.137	0.527
RI(1) 0.320 km											1.000	−0.701	0.017	0.004	0.006	0.157	0.017	−0.049	0.467	−0.029
LO(1) 0.00148 deg												1.000	−0.018	0.021	0.091	0.198	−0.412	0.091	−0.304	0.112
RI(3) 0.058 km													1.000	0.966	−0.104	0.034	0.011	−0.098	0.041	−0.117
LA(3) 0.00074 deg														1.000	0.072	−0.015	−0.013	0.063	−0.025	0.062
LO(3) 0.00062 deg															1.000	−0.161	−0.095	0.927	−0.357	0.957
RI(4) 0.058 km																1.000	−0.773	−0.210	0.072	−0.141
LA(4) 0.00077 deg																	1.000	−0.091	0.095	−0.105
LO(4) 0.00064 deg																		1.000	−0.409	0.934
RI(5) 0.025 km																			1.000	−0.394
LO(5) 0.00062 deg																				1.000

	R	ϕ	λ	V	γ	σ
R 0.128 km	1.000	−0.737	0.619	0.874	−0.799	0.648
ϕ 0.00123 deg		1.000	−0.784	−0.719	0.828	−0.415
λ 0.00066 deg			1.000	0.797	−0.696	0.131
V 0.029 m/sec				1.000	−0.872	0.654
γ 0.00002 deg					1.000	−0.710
σ 0.00012 deg						1.000

Up to this point, *REM* has been treated as an independent parameter within the ODP. In reality, *REM* is related to $GM_\oplus$ and $GM_\mathbb{C}$ by the following constraint (Refs. 7 and 8)

$$REM = 86.315745\,(GM_\oplus + GM_\mathbb{C})^{1/3}$$

The *REM* value obtained from the above equation, using the ODP solutions for $GM_\oplus$ and $GM_\mathbb{C}$, is 6378.3144 km, and the ODP solution is 6378.3080 km. The difference between these two values is well within the uncertainty; however, the estimated parameter statistics are corrupted by treating *REM* as an independent parameter. To show this, an approach by D. L. Cain[5] was used to apply the constraint to both the best premaneuver and postmaneuver solutions (i.e., the premaneuver orbit with postmaneuver data as a priority, and the postmaneuver orbit with premaneuver data as a priority). Briefly, this method sets the constraint equation equal to G,

$$G = REM - 86.315745\,(GM_\oplus + GM_\mathbb{C})^{1/3} = 0$$

and then uses the method of Lagrange multipliers to minimize the original function and constrain G. That is

$$\mathbf{q}_o = A^T W A$$

and

$$\mathbf{q}_c = A^T W A + \lambda G$$

where

$\mathbf{q}_o$ = original function

$\mathbf{q}_c$ = constrained function

A = residual = observed value − computed value

W = weight on data

λ = vector of Lagrange multipliers

When the first order terms are collected after taking partials to minimize $\mathbf{q}$, the resulting solution can be expressed in terms of the original solution plus one additional term. The new solution vector $\mathbf{q}_n$ is obtained by

$$\mathbf{q}_n = \mathbf{q}_o + \delta\mathbf{q}$$

where

$$\delta\mathbf{q} = \Lambda_o\, C^T\,(C\Lambda_o\, C^T)^{-1}\, D$$

$$C = \frac{\partial G}{\partial \mathbf{q}}$$

D = the value of G when the estimates for *REM*, $GM_\oplus$, and $GM_\mathbb{C}$ from the original orbit solution are placed in the constraint equation

Λ_o = covariance matrix from the orbit solution

The constrained statistics are

$$\Lambda_c = \Lambda_o - \Lambda_o\, C^T\,(C\Lambda_o\, C^T)^{-1}\, C\Lambda$$

The above computations were performed using the solutions from both the premaneuver orbit with postmaneuver data, and the postmaneuver orbit with premaneuver data. These results are presented in columns 6 and 9 of Table 5, in which it can be seen that the uncertainties in the Cartesian coordinates and the physical constants have been significantly reduced. Again note the consistency of the statistics in station locations and physical constants for the two cases.

It remains to be established that the orbit solution is not corrupted by treating *REM* as an independent parameter. This is most easily accomplished by passing the orbit defined by the constrained or new solution vector $\mathbf{q}_n$ through the data. If the constraint does corrupt the orbit, the noise level in the data will increase. Figures 8 through 13 show the premaneuver doppler residuals based on the premaneuver orbit with postmaneuver data as a priority plus the constrained solution vector. Figures 14 through 24 show the residuals from the postmaneuver orbit with premaneuver data a priority plus the constraint. In both cases, deviations from the residuals seen in the previous orbital estimates were insignificant. This can be verified by comparing the residuals in the Figures to those listed in the ODP printouts in Appendixes E and F for the appropriate data block. It is to be noted that these listings pertain to previous orbit estimates and not the constrained solutions. Further verification can be obtained by referring to Tables 4 and 11. For both orbits, the data statistics are almost identical with those of other estimates.

The best estimate of the maneuver can now be obtained by using the constrained solutions. The numerical values are shown in Table 17, and a more complete discussion of the estimated maneuver is given in Section III C.

Conclusions based on the foregoing analysis are that the best estimates for both the premaneuver and postmaneuver orbits are obtained by combining the two data blocks for a given calculation. Further, the most realistic statistics for the estimated parameters are obtained by applying the *REM* constraint to the combined estimates.

3. Observations and Conclusions

a. Station locations. There is considerable information available in the tracking data for determining station

[5]D. L. Cain, "Least Squares With Side Constraints," January 2, 1963 (internal communication).

Table 17. *Ranger VII* maneuver estimate based on constrained solutions

Premaneuver position and velocity[a]	Postmaneuver position and velocity[b]	Position and velocity change due to maneuver (postmaneuver–premaneuver)
$X = 156674.69$ $\Delta X = -0.63$ $X+\Delta X = 156674.06 \pm 0.4$	156674.59 ± 0.4	0.5 km
$Y = 63042.780$ $\Delta Y = -0.381$ $Y+\Delta Y = 63042.399 \pm 1.8$	63041.361 ± 1.6	−1.0 km
$Z = 8079.7165$ $\Delta Z = -0.1552$ $Z+\Delta Z = 8079.5613 \pm 3.3$	8078.2511 ± 4.3	−1.3 km
$DX = 1.4594170 \pm 0.0028$	1.4342624 ± 0.0028	−25.0546 m/sec
$DY = 0.98778791 \pm 0.0046$	0.97256707 ± 0.0046	−15.2208 m/sec
$DZ = 0.28737684 \pm 0.0165$	0.28116743 ± 0.0111	−6.2094 m/sec

[a] Based on premaneuver orbit calculation using postmaneuver data as a priority and *REM* constraint applied.
[b] Based on postmaneuver orbit calculation using premaneuver data as a priority and *REM* constraint applied.
Note: Δ's are the positional change during maneuver motor burn from the relationship

$$\Delta X = \frac{1}{2} a_x t^2 = \frac{\dot{v}_x t}{2}, \quad \Delta X \rightarrow \Delta Y \rightarrow \Delta Z.$$

locations. This is not immediately obvious since examination of the correlation matrixes from the various orbit calculations indicate that there is only information on station longitude. However, if the X_1, X_2, X_3 coordinate system[6] in Fig. 25 is used, it will show that another direction is determined better than longitude.

[6] D. L. Cain, "Tracking Station Coordinate System," June 24, 1964 (internal communication).

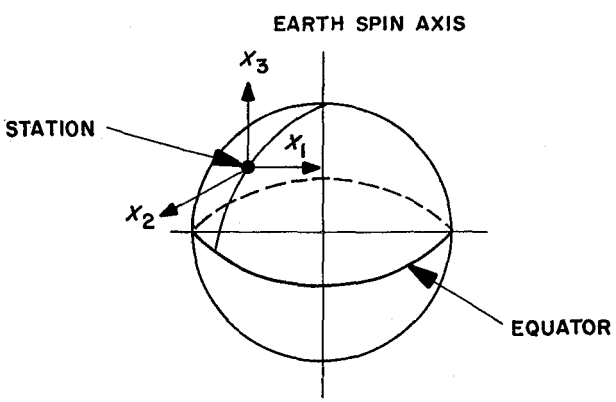


Fig. 25. X_1, X_2, X_3 coordinate system

where X_1 is in Earth's equator, station meridian, normal to Earth's spin axis (such as station longitude)

X_2 is East

X_3 is in direction of Earth's spin axis.

As previously mentioned, X_1 and X_2 may be well determined; but, since X_3 is parallel with the Earth's spin axis, it is not well determined. This is very evident in Table 18 which shows the 10 × 10 normalized covariance matrix on station locations rotated from the radius, latitude, longitude system into the X_1, X_2, X_3 system. The 1-σ a priority used in the initial estimation was 500, 500, and 100 m for X_1, X_2, and X_3, respectively. From the uncertainties in the final estimate, it can be seen that no new information was available on X_3. The best estimate of X_1 and X_2 was obtained from the Station 12 tracking data. This is due to the fact that this Station provided longer tracking coverage (essentially from horizon to horizon) and had the best data quality. Results of *Ranger VII* indicate an improvement in the station location solutions. Table 19 contains a summary of the solutions obtained from the tracking data taken during previous missions. All comparisons are made with respect to land survey locations designated as "old survey." The "new survey"

Table 18. Station location statistics

Standard deviations, m		X_1 (59)	X_2 (59)	X_1 (12)	X_2 (12)	X_3 (12)	X_1 (41)	X_2 (41)	X_3 (41)	X_1 (51)	X_2 (51)
288.294	X_1 (59)	1.000	−0.704	0.095	−0.035	0.008	0.301	−0.134	−0.034	0.503	−0.107
148.640	X_2 (59)		1.000	−0.153	0.091	0.009	−0.268	0.080	−0.367	−0.302	0.131
8.814	X_1 (12)			1.000	−0.130	−0.035	0.195	−0.045	−0.007	0.029	−0.205
23.491	X_2 (12)				1.000	0.044	−0.027	0.677	−0.008	−0.140	0.781
99.880	X_3 (12)					1.000	−0.007	0.028	−0.004	−0.005	0.015
29.225	X_1 (41)						1.000	−0.214	0.0	0.126	−0.001
30.913	X_2 (41)							1.000	0.028	−0.257	0.723
98.520	X_3 (41)								1.000	0.044	−0.037
21.564	X_1 (51)									1.000	−0.228
28.322	X_2 (51)										1.000

Table 19. Station location comparison

Station[a]	(12)	(41)	(51)	(12)-(41)	(12)-(51)	(41)-(51)
	Mariner II Δ[b] = (*Mariner II*) − (old survey)					
ΔX_1	−157.8					
ΔX_2	−93.2					
ΔX_3	−110.4					
σX_1	13.5					
σX_2	44.0					
σX_3	99.9					
	New survey Δ = (new survey) − (old survey)					
ΔX_1	−133.3	−63.5	−17.8			
ΔX_2	−103.2	−3.3	0.0			
ΔX_3	191.0	41.4	−16.1			
σX_1	26.0	26.0	26.0	36.8	36.8	36.8
σX_2	26.0	26.0	26.0	36.8	36.8	36.8
σX_3	26.0	26.0	26.0	36.8	36.8	36.8

Station[a]	(12)	(41)	(51)	(12)-(41)	(12)-(51)	(41)-(51)
	Ranger VI Δ = (*Ranger VI*) − (old survey)					
ΔX_1	−169.5	25.0	−81.9	−194.5	−87.6	106.9
ΔX_2	−123.2	122.1	−45.5	−245.3	−77.7	167.6
ΔX_3	−1.6	48.3	−49.0	−49.9	47.4	97.3
σX_1	9.6	38.0	19.0	39.2	21.6	43.6
σX_2	35.5	43.3	40.0	21.5	18.8	22.2
σX_3	99.8	83.0	92.0	128.4	135.9	111.3
	Ranger VII Δ = (*Ranger VII*) − (old survey)					
ΔX_1	−166.4	2.7	−63.4	−169.1	−103.0	66.1
ΔX_2	−112.1	143.2	−38.9	−255.3	−73.2	182.1
ΔX_3	2.7	−12.7	−30.6	15.4	33.3	17.9
σX_1	8.8	29.2	21.6	30.5	23.3	36.3
σX_2	23.5	30.9	28.3	22.9	17.7	22.2
σX_3	99.9	98.5	100.0	140.3	141.4	140.4

[a] DSIF 12 — Goldstone Echo site, California.
DSIF 41 — Woomera, Australia.
DSIF 51 — Johannesburg, South Africa.

[b] All differences and uncertainties, σ's, are in meters.

refers to a reevaluation[7] of locations required when the basic reference, the Clarke spheroid of 1866, was changed to the "Kaula" or "165" spheroid. In addition, new survey data for Station 41 (Woomera, Australia) was included. Stations 41 and 51 will soon use rubidium frequency standards which should bring their data quality up to that of Station 12. It will then be possible to use pseudo two-way doppler[8] to obtain horizon to horizon data for each station. Hence, in future missions it should be possible to reduce the location uncertainties for these stations.

[7] J. Heller and H. Kieffer, "DSIF Station Locations," May 1964 (internal communication).

[8] This data type is obtained when one station is transmitting and another station is receiving. Thus one station is receiving two-way and the other pseudo two-way. For the *Ranger* missions the data quality of the pseudo two-way was too poor to use for location studies.

b. Physical constants. Excellent estimates of the physical constants $GM_{\oplus}$, $GM_{\leftmoon}$, and *REM* were obtained from the tracking data. In Table 20 it may be seen that the uncertainty in $GM_{\oplus}$ is only 38% of that estimated by the International Astronomical Union in 1961. Comparison between the *Ranger VI* and *VII* results show very close agreement. Results of *Ranger 3, 4,* and *5* have been included to show the consistency obtained from the *Ranger* missions. Solution uncertainties for *Ranger 4* and *5* are large due to the limited amount of available data (first 8 hr of mission).

Table 20. Physical constants estimate

Source	Value, km^3/sec^2	Standard deviation, km^3/sec^2	Remarks
GM_{Earth} estimates = $GM_{\oplus}$			
Nominal JPL[a]	398603.20	±4.0	
Ranger 3	398600.49	±4.1	4 days of tracking
Ranger 4	398601.87	±13.3	8 hr of tracking
Ranger 5	398599.20	±13.2	8 hr of tracking
Ranger VI[b]	398600.61	±1.1	65 hr of tracking
Ranger VII[b]	398601.28	±1.5	68 hr of tracking
GM_{Moon} estimates = $GM_{\leftmoon}$			
Nominal JPL (Prior to *Mariner* '62)	4900.7589	±5.0	
Nominal JPL (After *Mariner* '62)	4902.7779	±0.3	Venus cruise data taken during *Mariner* '62
Ranger VI[b]	4902.6182	±0.14	65 hr of tracking
Ranger VII[b]	4902.5801	±0.17	68 hr of tracking

[a]Kaula, 1961 (adopted by the Ad Hoc NASA Standard Constants Committee, Ref. 12).

[b]With *REM* constraint applied.

The uncertainty in the $GM_{\leftmoon}$ solution for *Ranger VII* has been reduced to 57% of the nominal JPL value adopted after the *Mariner II* mission. Comparison between *Ranger VI* and *VII* shows even better agreement than that seen for the $GM_{\oplus}$ uncertainties. The consistency between the two *Ranger* solutions and the *Mariner* solution is of significant interest since they were obtained by two different methods. That is, the *Mariner* solution was obtained by the 28-day periodic effect of the Moon in *Mariner's* cruise phase data (Ref. 9), whereas the *Ranger* solution was derived solely from the direct gravitational force of the Moon. Estimates for $GM_{\leftmoon}$ were not made from *Ranger 3, 4,* and *5* data.

Since large a priori values (uncertainties) were used for the physical constants in the initial estimations (Table 5), it may be stated that the solutions were truly determined from the tracking data. With the constrained estimates on $GM_{\oplus}$ and $GM_{\leftmoon}$, an Earth–Moon mass ratio can be determined as follows:

$$\mu^{-1} = \frac{GM_{\oplus}}{GM_{\leftmoon}} = \frac{398601.28}{4902.5801} = 81.3044 \pm 0.0026$$

This value may be compared with the *Mariner* and *Ranger VI* results given below

$$\mu^{-1}_{Mariner} = 81.3015 \pm 0.0034 \text{ (Ref. 9)}$$

$$\mu^{-1}_{Ranger\ VI} = 81.3036 \pm 0.0023 \text{ (Ref. 10)}$$

c. Impact point. The 1.5 sec difference between the ODP-predicted and the station-observed impact time during *Ranger VI* (Ref. 10) caused an extensive reexamination of the JPL Trajectory Program and the ODP, the mathematical models used within these Programs, and the physical system at the observing station. No error sources were found which could account for this time difference. This led to the hypothesis that the actual lunar elevation at the impact point differed from that shown on Air Force Lunar Map LAC 60 (Ref. 11). To account for the time difference, a 3 km decrease in elevation would be required. An elevation of 1735.3 ± 0.2 km resulted from subtracting 3 km from the 1738.3-km elevation shown on LAC 60. For *Ranger VII*, a time difference of 1.14 sec results from using the nominal lunar radius of 1738.09 km (Ref. 12). To account for this, a decrease in elevation of 2.7 km would be required. This amount, when subtracted from the 1737.9 km elevation shown on map LAC 76 (Ref. 13) gives a lunar elevation of 1735.2 ± 0.4 km at the *Ranger VII* impact point. The *Ranger VI* and *VII* results (summarized in Table 21) are consistent. A comparison between the *Ranger VI* lunar radius and Yaplee's measurements (Ref. 14) may be found in Ref. 10.

The best ODP estimate of the lunar latitude and longitude of the *Ranger VII* impact point is −10.70 and −20.67 deg (Table 7, column 5), respectively. The uncertainty on this point is bounded by the selenocentric dispersion ellipse having a *SMAA* of 1.59 km and a *SMIA* of 0.36 km (Table 8, column 5). Preliminary values of latitude and longitude, based on analysis of *Ranger VII* lunar TV photos and Air Force lunar maps, are −10.62 and −20.59 deg (Table 7, column 6), respectively.[9] In

[9]These are preliminary values obtained by personal communication with D. E. Willingham of JPL.

Table 21. Lunar elevation results (*Ranger* impact point from center of gravity)

Mission	Recorded impact time[a], GMT	Calculated impact time[b], GMT	ΔT = recorded minus calculated, sec	VN = velocity normal to lunar surface	$VN \times \Delta T$, km	Radius of Moon to match recorded time, km	Best radius $R_\mathbb{C}$ from Air Force lunar map, km	$R_\mathbb{C}$ (lunar map) minus $R_\mathbb{C}$ (*Ranger*), km	Latitude of impact, deg	Longitude of impact, deg
Ranger VI	09:24:31.86 (±0.005[s])	09:24:30.29 (±0.15[s])	1.57	1.80 km/sec	2.83 (±0.3)	1735.3 (±0.3)	1738.4	3.1	9.44	21.50
Ranger VII	13:25:48.80 (±0.005[s])	13:25:47.66 (±0.19[s])	1.14	2.35 km/sec	2.68 (±0.4)	1735.2 (±0.4)	1737.9	2.7	−10.70	−20.67

[a] Recorded impact time corrected for signal transit time.
[b] ODP calculated impact time based on a lunar radius of 1738.09 km.

the TV records, the location of the impact point is well known with respect to surrounding topographic features. However, at control points located within a 2-deg circle of the impact point, there is a ⅓-km uncertainty in the location of the grid lines. The difference between the ODP estimate and the TV estimate (ODP − TV) is −0.08 deg for both latitude and longitude. On the lunar surface, these differences are approximately equivalent to 2.4 km. Figures 26 and 28 are advance unedited proofs of new lunar charts based on *Ranger VII* TV records, and Figs. 27 and 29 are unedited sectional details of Figs. 26 and 28, respectively. All Figures show the trace of the TV camera lens reticles converging to the impact point. The numbers appearing near the traces are TV frame numbers. In Figs. 28 and 29 the spacecraft trajectory as determined from the TV photos (represented by the heavy dashed line in the upper left portion) is also shown converging to the impact point.

4. Limitations

This section discusses the limitations of the *Ranger VII* flight path analysis described in this Report, and predicts the outcome to be expected from a more extensive analysis which will be undertaken after the completion of the *Ranger* Block III (*Ranger 6* through *9*) missions. The *Ranger Block III Summary Analysis* will be performed with the aid of the "next generation" ODP now being developed at JPL.

The ODP used for the *Ranger VII* analysis lacks certain desirable capabilities which will be incorporated in the next generation ODP. The principal items are summarized in Table 22. It is significant to note that errors introduced during computations due to interpolation and the buildup of roundoff error are the major contributions to the two-way doppler weighting sigma discussed in Section II C. This means that the full potential of the DSIF tracking data has not been realized in the *Ranger VII* analysis. The two-way doppler weighting sigma (for one sample/min at Station 12 at lunar encounter) can be reduced from 0.013 m/sec to less than 0.005 m/sec if the computing noise is made negligible compared to the other error sources. The buildup of computing error acts as a low frequency noise source. Such an error usually is not detectable in plots of the doppler residuals such as Figs. 8 through 24. These plots tend to illustrate only the high frequency noise sources.

In addition to the computing noise discussed above, other numerical limitations exist in the analysis. Their existence is illustrated by the fact that certain constraints hold only to a limited precision. Examples include the physical constant solutions and the spacecraft position at the midcourse maneuver epoch. The physical constant solutions obtained from using the results of premaneuver data as a priori information when processing postmaneuver data should be identical to the physical constant solutions obtained when using the results of postmaneuver data as a priori information when processing premaneuver data, in that both orbits use the same set of data but in a different order. Table 6 compares the physical constant solutions from these two orbits. Although the standard deviation of each physical constant shown in Table 5 exceeds the discrepancy between the two solutions, it is still clear that numerical difficulties do exist. For example, $\Delta GM_\mathbb{C} = 0.10$ km³/sec² is a variation in the 5th digit where a variation in the 8th digit may be expected due to roundoff, in that although the same computations are performed, they are accomplished in a different sequence for the two solutions. Notice that $\Delta GM_\mathbb{C}$ is overshadowed by the $\sigma_{GM_\mathbb{C}} = 0.15$ km³/sec² for

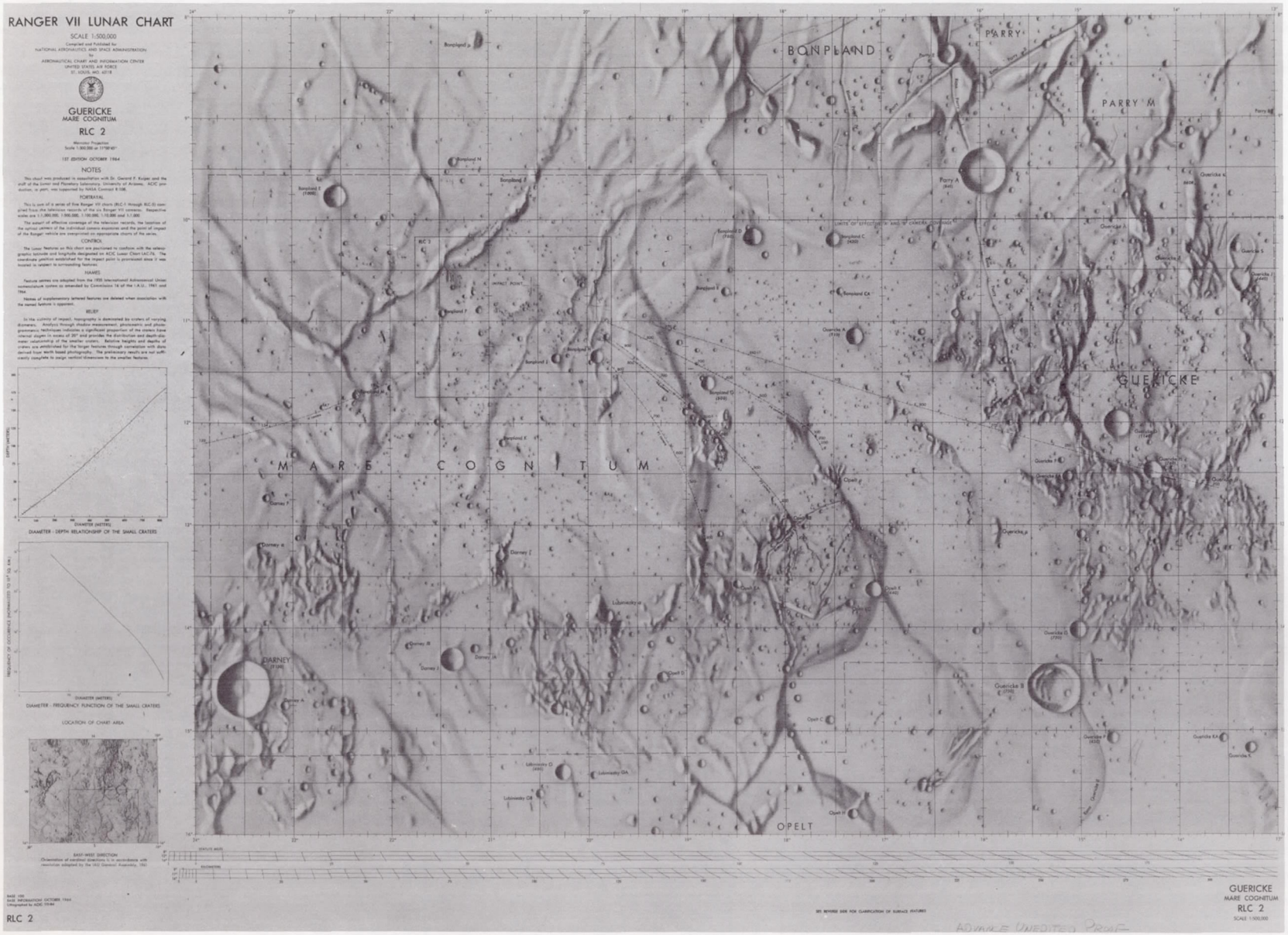


Fig. 26. Advance unedited proof of *Ranger VII* lunar chart RLC 2

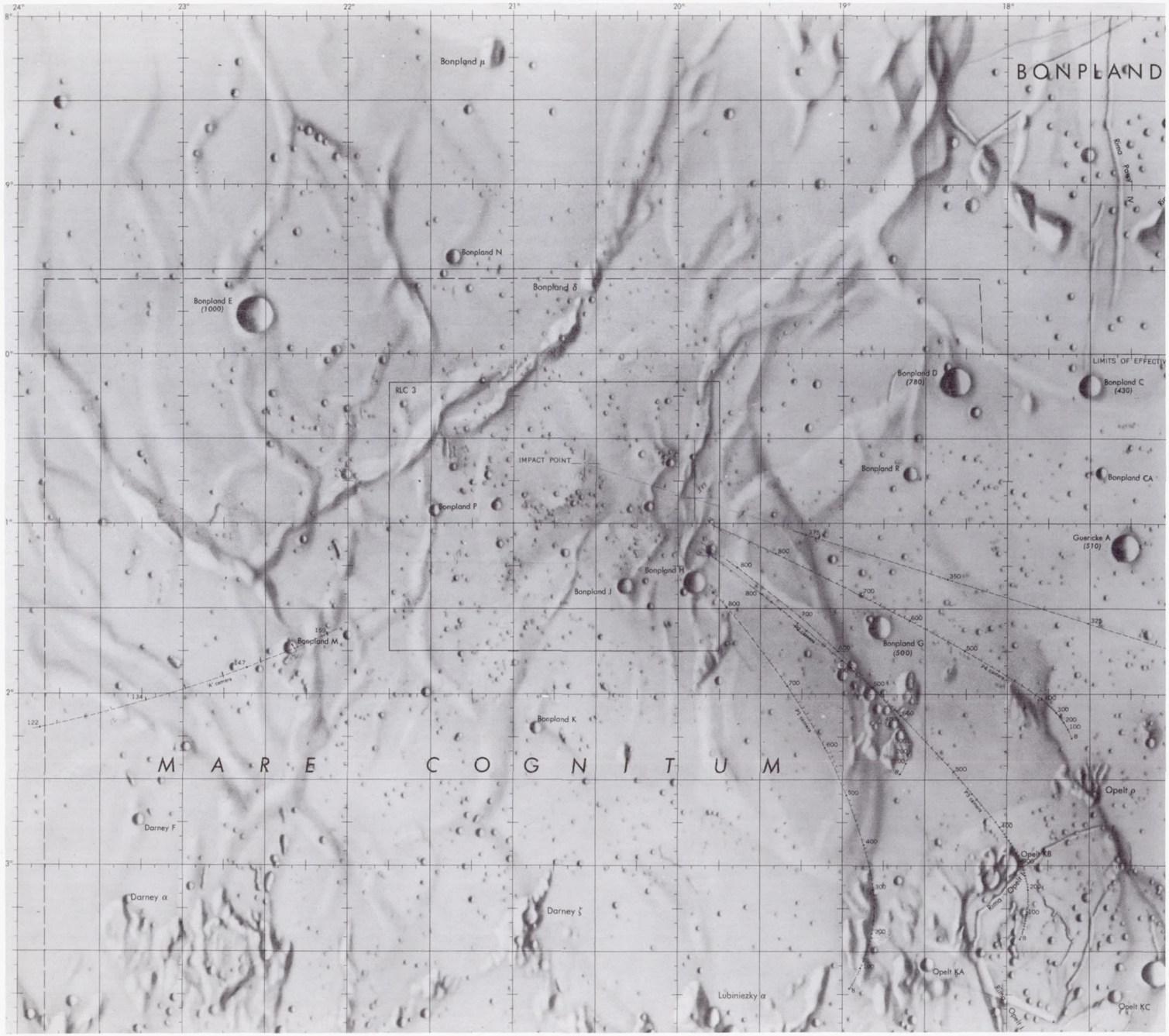


Fig. 27. *Unedited sectional detail of Ranger VII lunar chart RLC 2*

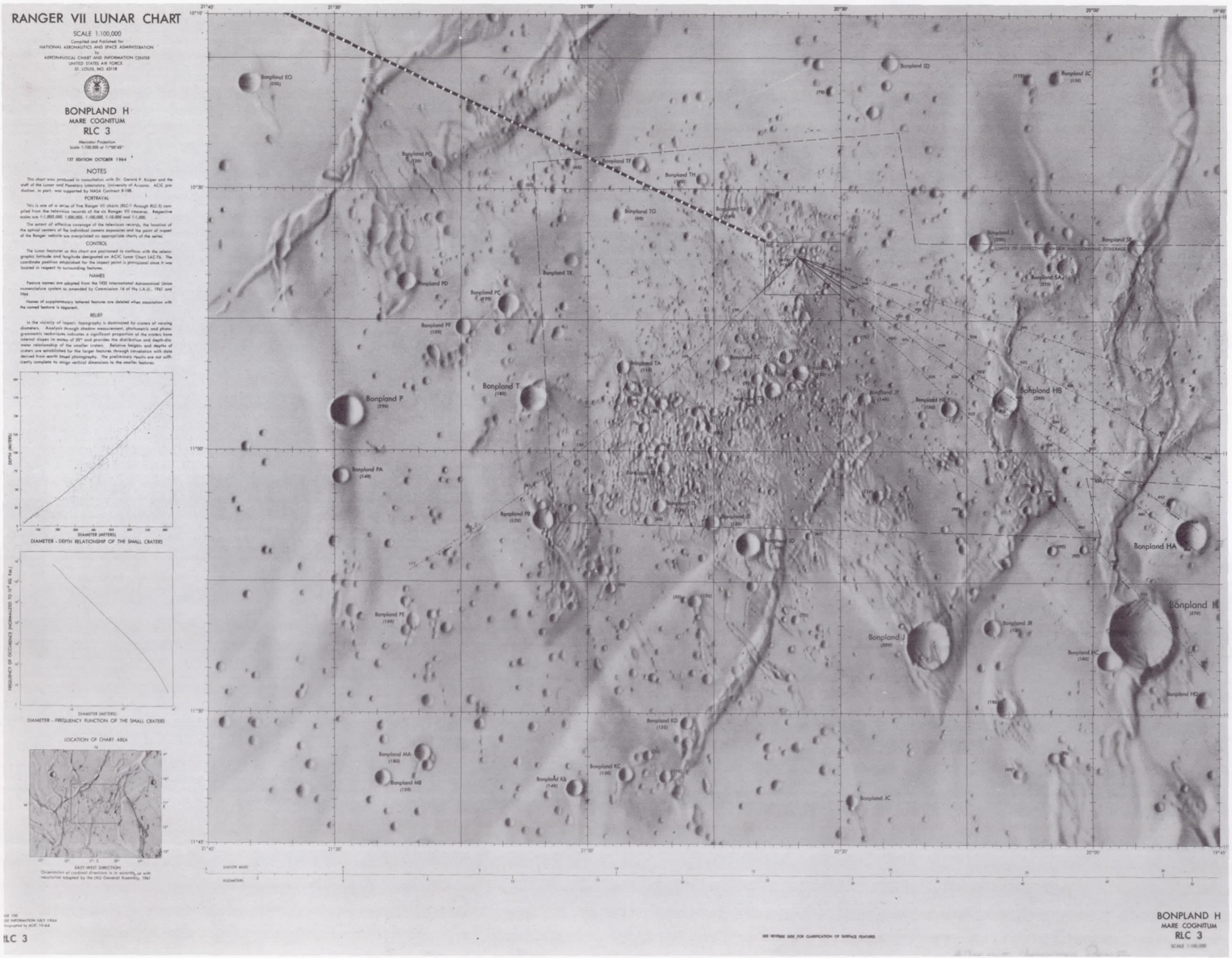


Fig. 28. Advance unedited proof of *Ranger VII* lunar chart RLC 3

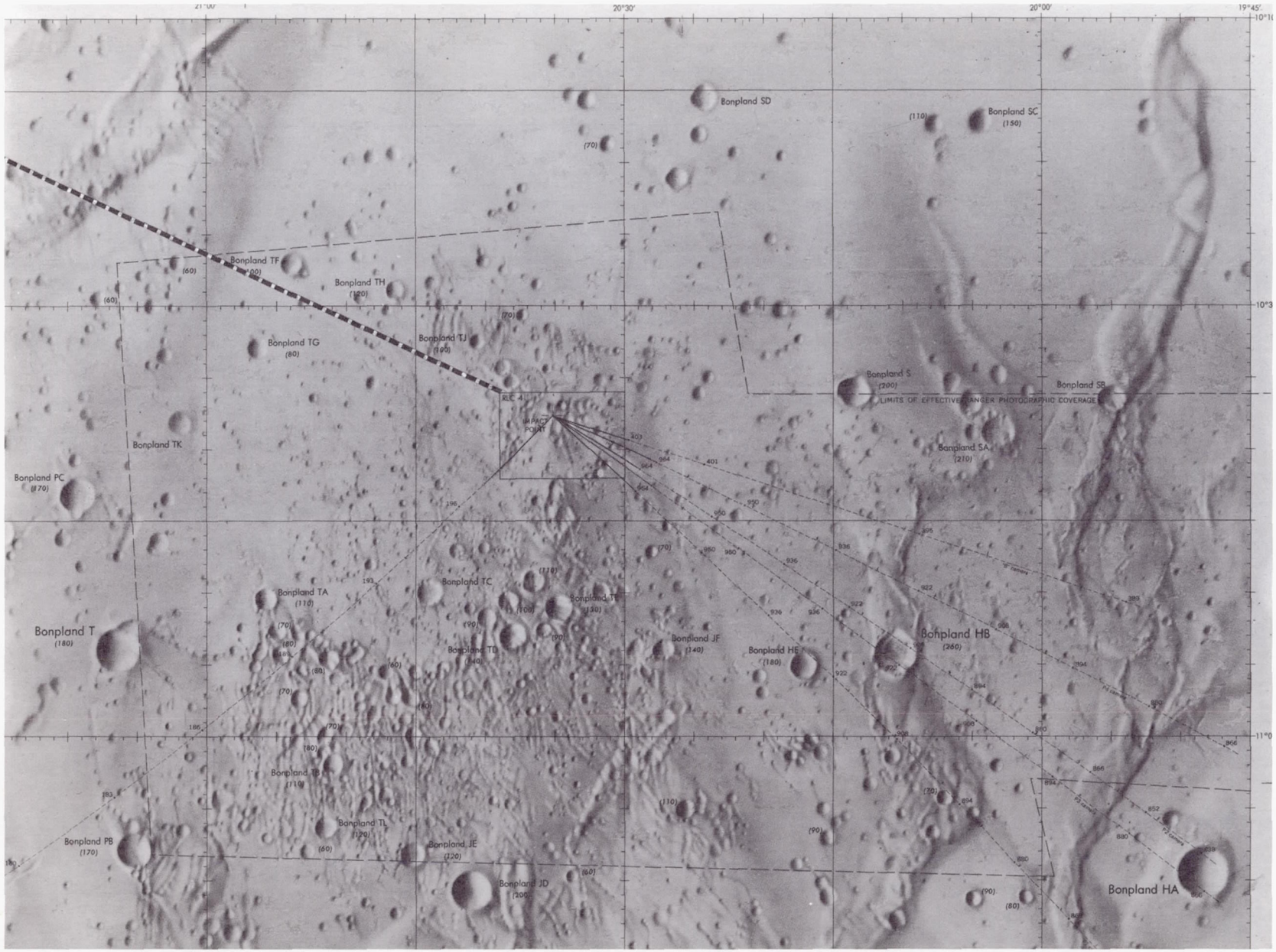


Fig. 29. Unedited sectional detail of *Ranger VII* lunar chart RLC 3

Table 22. Limitations of *Ranger VII* analysis which will be overcome for *Ranger Block III Summary Analysis*

Limitation of ODP used for *Ranger VII* analysis	Characteristics of "next generation" ODP which will be used for *Ranger Block III Summary Analysis*
1. Trajectory and most other computations are in single precision. Errors are introduced during computations due to interpolation and the buildup of roundoff error, which are the main contributions to the data weighting sigma, e.g., computing noise contributed 0.012 m/sec out of a total station weighting sigma of 0.013 m/sec for 12 two-way doppler near lunar encounter.	1. Double precision will be used throughout. The computing program will be formulated and the trajectory integration step size can be chosen to ensure that computing noise is a minor contributor to the data weighting sigma.
2. A fixed empirical correction is applied for tropospheric effects. Ionospheric effects are ignored but could appear as an "inward" displacement for a daylight tracking pass.	2. Ionospheric corrections will be applied and a more sophisticated model will be incorporated for the troposphere.
3. Certain operations must be carried out external to the ODP. This sometimes makes an exact iterative solution cumbersome and impractical. These external operations include: a. The application of the $GM_{\oplus}$, $GM_{\leftmoon}$, *REM* constraint (maintains the "calculated" period consistent with the "observed" period of the Moon).[a] b. Velocity increments due to the midcourse maneuver (and the spring separation of the spacecraft from the launch vehicle when applicable) are not automatically "solved for" and the ODP does not properly constrain the spacecraft position at these maneuver points.	3. Maneuver velocity increments will be added to the solution vector and the necessary constraints will be incorporated in the ODP. Tracking data from injection to lunar impact can be processed in a single run as opposed to the premaneuver and postmaneuver segments which had to be treated separately for the *Ranger VII* analysis.
4. Size of solution vector is limited to 20 parameters. Twenty parameters were used for the *Ranger VII* analysis which did not include the maneuver velocity increments, nor all of the tracking station location parameters in the solution vector.	4. Size of solution vector will be nominally 50 parameters but will vary depending on nature of run. This will allow the inclusion of added parameters mentioned under (3) above.

[a] *The lunar ephemeris is an input to the ODP, and the "observed" angular position of the Moon with respect to the Earth is fixed, independent of the $GM_{\oplus}$, $GM_{\leftmoon}$, REM solutions.*

this analysis, but it will not be acceptable for the *Summary Analysis* which should yield a $\sigma_{GM_{\leftmoon}} = 0.03$ km³/sec² as discussed below.

The discrepancies in spacecraft position at the midcourse maneuver epoch are shown in Table 17, in which, for example, the spacecraft is displaced 1.3 km in the Z direction above what the magnitude of the maneuver would indicate. The current ODP constrains these positions statistically through the application of an a priori covariance matrix but does not include a physical constraint. The $GM_{\oplus}$, $GM_{\leftmoon}$, *REM* constraint was applied as a side condition (Section II F 2), after the ODP processed the postmaneuver data, using the results of the premaneuver data as a priori information. That is, the constraint is not applied in the iterative process but only after the orbit has converged without recognizing the constraint.

The next generation ODP will be formulated and the trajectory integration step size can be chosen to ensure that during postflight analysis computing noise will be a minor contributor to the data weighting sigma. In addition, the maneuver velocity increments will be added to the list of "solve for" parameters, and the equations which constrain the spacecraft positions at maneuver epoch and which constrain the $GM_{\oplus}$, $GM_{\leftmoon}$, *REM* parameters will be added to the regression model. Also, the atmospheric refraction model will be improved in that the ionosphere effects will be added, and the tropospheric model will be increased in sophistication. In addition, the size of the solution vector will be increased from its present limit of 20 parameters to allow the inclusion of the maneuver velocity increments, the remainder of tracking station location parameters, and, possibly, timing biases which may be important within the first few hours after launch.

It is desirable to develop a model complete enough so that the "fitters world" will contain all the parameters necessary to represent the "real world" data (remove all trends from the residuals) so that realistic statistics are

Table 23. Physical constant statistics: comparison between *Ranger VII* analysis and *Ranger Block III Summary Analysis*

Physical constant	Standard deviation	
	Ranger VII postflight analysis	*Ranger Block III Summary Analysis*
$GM_\oplus$	1.40 km^3/sec^2 = (3.5×10^{-6}) $GM_\oplus$	0.4 km^3/sec^2 = (1×10^{-6}) $GM_\oplus$
$GM_\mathbb{C}$	0.15 km^3/sec^2 = (30×10^{-6}) $GM_\mathbb{C}$	0.03 km^3/sec^2 = (6×10^{-6}) $GM_\mathbb{C}$
REM	7.3 m = (1.1×10^{-6}) *REM*	2 m = (0.3×10^{-6}) *REM*
Station locations[a]		
x_1 (outward radial distance normal to Earth's spin axis)	17.7 m	5 m
$x_{2i} - x_{2j}$ (difference in longitude between two stations)	8.8 m	5 m

[a] The *Ranger VII* analysis quotes results for Station 12 and ignores the effect of the ionosphere. The majority of the Station 12 doppler were obtained at night when ionospheric effects were at a minimum.

associated with the solution vector parameters. Table 23 is a comparison of the physical constant statistics between the *Ranger VII* postflight analysis and the *Ranger Block III Summary Analysis*. An improvement factor of 3 is realized for $GM_\oplus$ and 5 for $GM_\mathbb{C}$. The slow relative motion of points on the Earth's crust (which will not be included in the ODP model) may limit the knowledge of station locations to 5 m in the radial direction normal to the Earth's spin axis, and 5 m in the difference in longitude between two stations. The major reduction in statistics is the result of the improved model (i.e., double precision, built-in constraints, midcourse maneuver model, improved refraction model) to be used for the *Summary Analysis*; however, some improvement will also be realized from combining the results of the *Mariner* (Venus and Mars) and the other *Ranger* flights for a consistent solution of the physical constants ($GM_\oplus$, $GM_\mathbb{C}$, *REM*, and tracking station locations). Also, data such as TV pictures of the spacecraft lunar impact point will be available as a check on the orbit determination process.

III. MIDCOURSE AND TERMINAL MANEUVER ANALYSIS

A. Introduction

The function of the Maneuver Analysis Group (MAG) of the Flight Path Analysis and Command Team was fully described in the maneuver part of the Report on the flight path of *Ranger VI* (Ref. 10). Summarized briefly here are the guidelines under which the exploration of maneuver alternatives is carried out for both standard and nonstandard flight sequences. The constraints and restraints imposed are as follows:

1. Mission

a. The impact location must have suitable lighting conditions at arrival. A precise quantitative criteria for measuring these conditions is given in Ref. 15 which predicts best results for regions with a lighting angle of 50–80 deg.

b. It is desirable to land in a mare area not far from the lunar equator (approximately within ±10 deg) for compatibility with the *Apollo* program.

c. If no suitable impact location can be achieved, it is desirable to maximize camera coverage of previously unphotographed portions of the Moon with a west-side flyby.

2. Spacecraft and Geometry

a. The magnitude of the corrective maneuver cannot exceed the maximum available.

b. The Earth–probe–near limb of the Moon angle must not fall below 15 deg in order to maintain Earth lock.

c. It is desirable that the flight time be adjusted so that the automatic preset timer on board the spacecraft will activate the fully scanned cameras no later than 5 min and no earlier than 45 min prior to impact.

d. The angle that the roll axis of the spacecraft makes with the probe–Earth line should not be less than 40 deg during the entire midcourse maneuver sequence. Violation of this constraint may or may not result in loss of telemetry during this critical time. Coordination with the Spacecraft Performance Analysis and Command Group (SPACG) is required in flight to determine the severity of the loss, if any, should the null cone be entered. If (c) and (d) may not be simultaneously attained, the timer takes preference over the telemetry.

e. It is desirable that both the midcourse and terminal phases occur well within a Goldstone viewing period.

f. In the terminal maneuver sequence the second pitch turn may not be less than −47 deg. In addition, it may not be greater than +55 deg if accurate roll stabilization is required.

Figure 30 shows several of these constraints mapped onto the **B** plane. The MAG is further able to evaluate in real time, during the execution of the midcourse maneuver sequence, the consequence of any roll and pitch (with some assumed velocity magnitude increment) should telemetry indicate that the turns being executed are significantly different from those commanded. The evaluation, using linear analysis, estimates target parameters for the maneuver being performed and weighs these against the target parameters for the trajectory with no midcourse perturbation. In carrying out the evaluation, a representative from the JPL Space Sciences Division is consulted before the recommendation is made as to whether or not the maneuver is to be inhibited and the spacecraft returned to its cruise mode by sending real-time command (RTC) 8.

The investigation as to the most desired terminal maneuver can be broken into four main possibilities:

a. The nominal terminal maneuver, which aligns the primary optical axis of the TV subsystem along the velocity vector at the point of impact by performing in sequence a pitch, a yaw, and a second pitch.

b. The optimum terminal maneuver, which seeks to make the optimum trade-off between camera smear due to misalignment between the cameras and the velocity and the viewing geometry.

c. A restricted maneuver, which pitches the spacecraft an amount equalling the algebraic sum of the first and second pitch computed in (a), above, thus increasing reliability.

d. No terminal maneuver at all, which further increases reliability.

The constraints on the midcourse maneuver mentioned above, apply here also in choosing the proper terminal maneuver. Figures 31 and 32 depict the midcourse roll–pitch turn and the terminal pitch–yaw–pitch turn sequences.

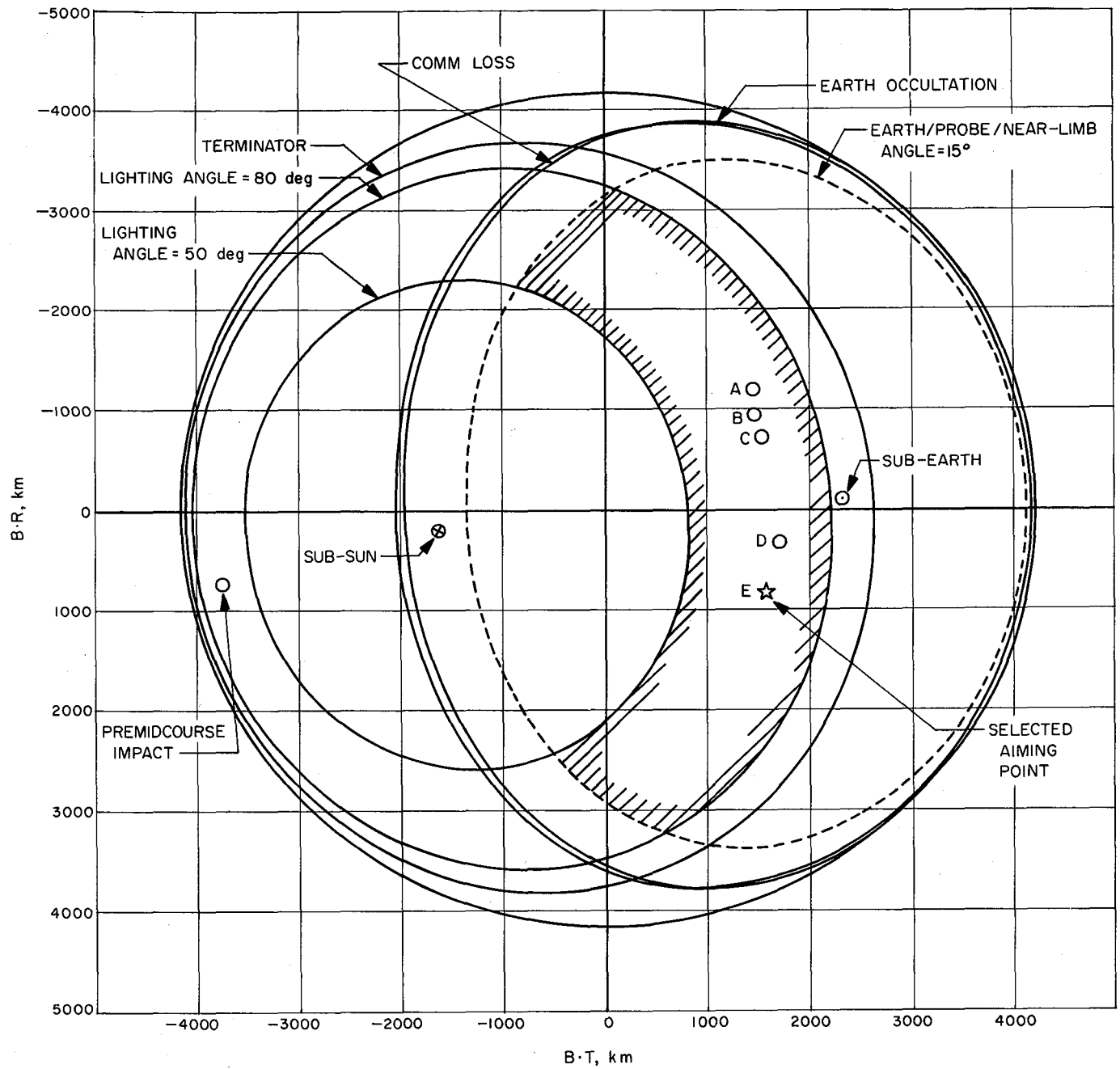


Fig. 30. *Ranger* midcourse maneuver

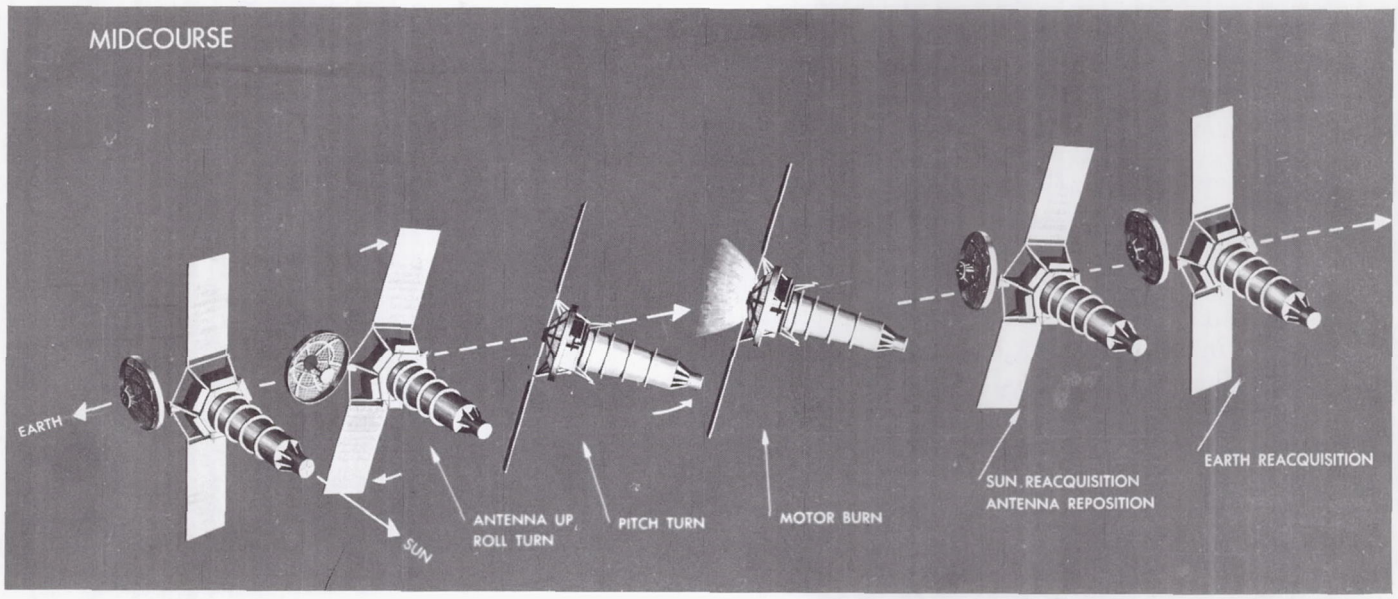


Fig. 31. *Ranger* terminal maneuver

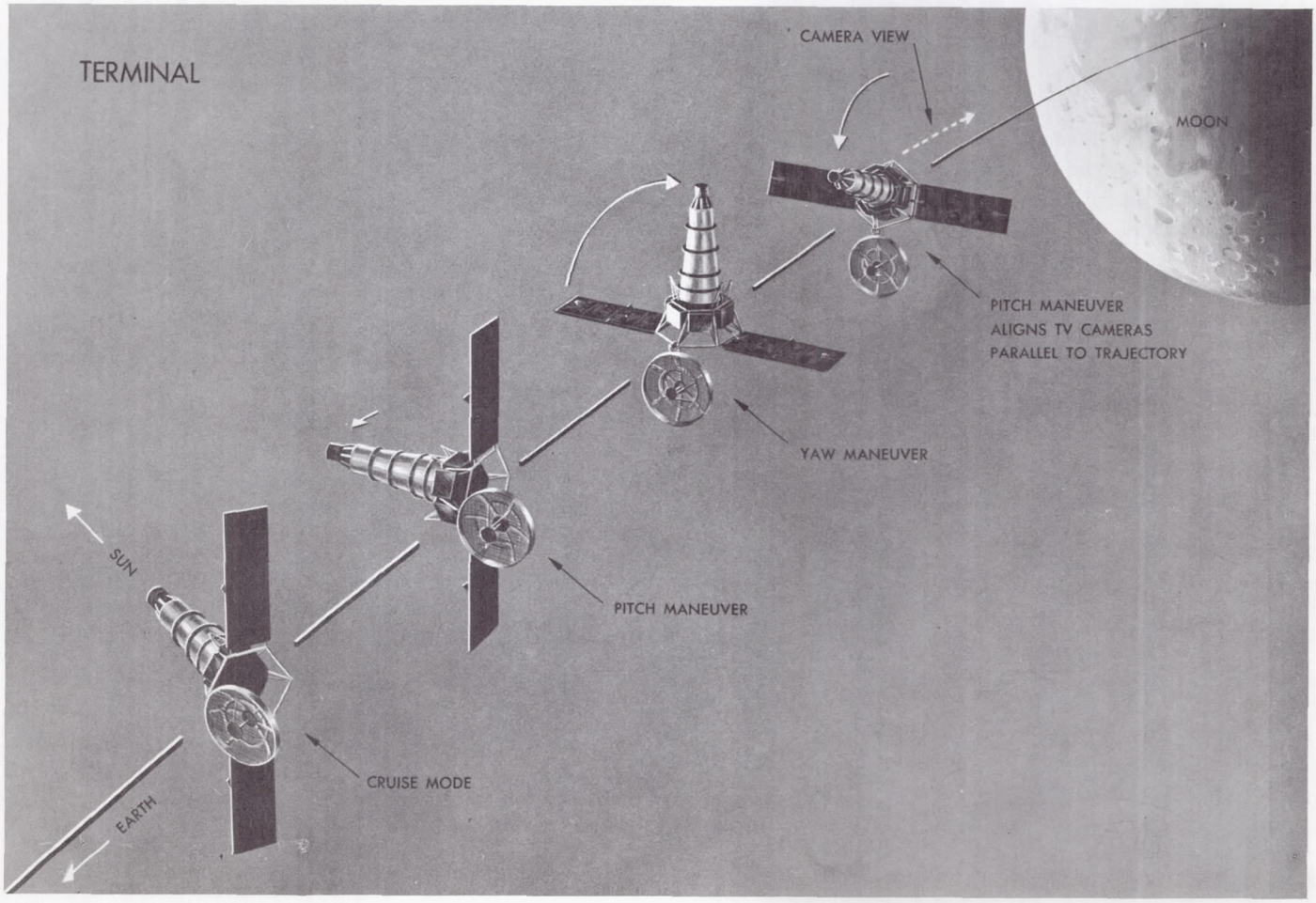


Fig. 32. Capability ellipse of target parameters 16 hr after injection

B. Inflight Maneuver Considerations

Among the various sites considered as a destination for *Ranger VII* for the July 28, 1964 launch, the northern part of Mare Nubium at 11 deg South latitude and 21 deg West longitude was selected as most desirable.[10]

With the computation of the first orbit early in the mission, it became clear that the most desired impact point could be achieved with much less than the total 60 m/sec capability of the midcourse rocket motor. The magnitude of the correction needed remained the same, as the orbit estimation was refined prior to the midcourse maneuver. The orbit upon which the final midcourse maneuver computation was based was the nominal pre-midcourse orbit. Table 24 shows the estimate of the arrival parameters of the nominal premidcourse orbit, the target parameters of launch, the desired impact parameters prior to midcourse, and the required change in the terminal conditions. Note that the target point at launch differs by 1700 km from the target point at midcourse, the difference being that the target point at launch is chosen so as to optimize the probability of impacting in the visible lighted portion of the Moon should a spacecraft malfunction preclude a midcourse maneuver, while the target point at midcourse is chosen by the criterion outlined above. The ellipse shown in Fig. 33 centers on the estimate of the target parameters from the nominal premidcourse orbit and describes the total range of the ability to alter these parameters with the 60 m/sec capability of the midcourse rocket.

A summary of statistics of dispersion at the target for the maneuver required is given in Table 25. Listed are the 1-σ values for the *SMAA* and *SMIA* of the dispersion ellipse in the **B** plane along with the uncertainty in time of flight. These quantities are given as contributed by orbit determination uncertainties, maneuver execution uncertainties, and the combined contribution.

[10]Letter dated June 18, 1964 from E. A. Whitaker to D. E. Willingham of JPL describing *Ranger VII* landing sites for the July launch window.

Table 24. Maneuver target conditions

	Aiming point at launch	Premaneuver orbit	Desired arrival point	Correction required
B·RT, km	222	759	820	61
B·TT, km	75	−3799	1607	5406
TF,** hr	68.2	67.23	68.09	0.86

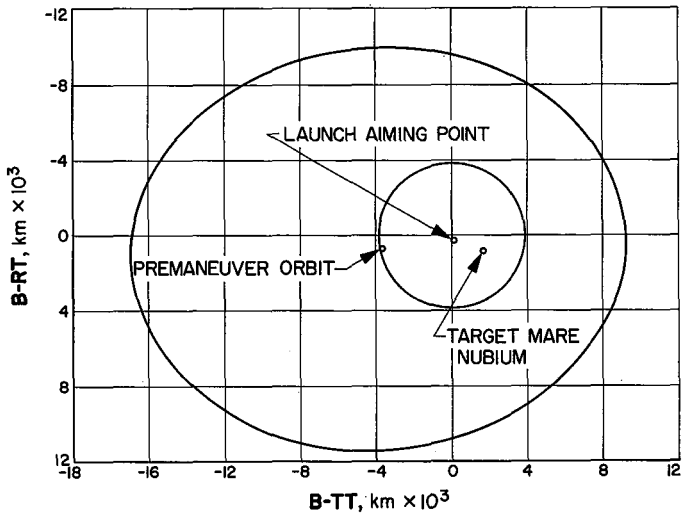


Fig. 33. *Ranger VII* constraints mapped onto the B plane

The flight time of *Ranger VII* was to have been adjusted so that impact would occur 30 min after the backup clock turned on the channel cameras. The maneuver to achieve the impact point and the desired flight time, however, violated the nominal antenna constraint angle of 40 deg. Because of the particular antenna radiation patterns and the particular rotations to be performed by the spacecraft, the number of channels and the time spent by each in the antenna nulls could be reduced by reducing the time from camera activation to impact. Several maneuvers for varying arrival times were computed; each was examined in detail by the SPACG for expected telemetry loss. A flight time with impact occurring 18 min after automatic camera turnon was ultimately decided upon. If, at this time, no terminal orienting maneuver were made, the lunar terminator would be within the field of view of the B camera, thus giving the cameras a wide range of surface illumination. The desired time of flight from injection to impact would be 68.09 hr.

Table 25. Expected target dispersions from orbit determination and midcourse maneuver execution errors

1σ	Orbit determination	Maneuver execution	Combined
Semimajor axis, km	14.6	45.7	47.7
Semiminor axis, km	6.3	35.9	36.8
Flight time uncertainty, sec	5.2	31.4	31.9
Orientation — angle from +**T** axis and **T** to +**R**, deg	6.9	−83.9	−88.3

Having determined the desired target parameters at approximately 3 hr prior to the initiation of the maneuver at 07:27:00 GMT, the final computation was made using the latest determination of the orbit. The resulting required maneuver parameters are entered in Table 26.

Table 26. Commanded maneuver

	Magnitude	Duration, sec	Initiated at GMT
Roll turn	5.56 deg	25	10:00:44
Pitch turn	−86.80 deg	392	10:10:09
Velocity increment	29.89 m/sec	48	10:27:09

Well before the maneuver was to be executed, consideration was given to the possibility of stopping the maneuver sequence with RTC-8, which interrupts the maneuver and returns the spacecraft to its cruise mode attitude, should a malfunction occur during the turning sequence of the midcourse maneuver. This decision of whether or not to halt the maneuver is particularly difficult to make in real time because once the maneuver is stopped, a period of 10,000 sec must elapse before a second attempt is undertaken. This delay due to the recycling period presents the possible problem of having to perform the maneuver over an overseas station with the further thought that the same malfunction that occurred in the first attempt might occur in the second attempt. Furthermore, the delay decreases the capability of the midcourse motor. Taking these considerations into account, the MAG was then prepared to evaluate in real time the direct telemetry readings on the duration and polarity of the turns, assuming the correct motor burn. Fortunately, such preparation was never utilized since the measurements observed in real time during the performance of the maneuver all had the correct polarity and, to within the accuracy of these measurements, were of the exact duration commanded. This, coupled with the real-time doppler reduction discussed elsewhere in this Report, gave almost instant verification that the maneuver had been executed correctly.

After subsequent tracking and determination of the postmaneuver orbit showed that the correction to the trajectory was indeed very close to that desired, consideration was given to performing a terminal orienting maneuver. Prior to computing a terminal maneuver the best estimate of the impact parameters was as follows:

Latitude of impact 10.84 deg South

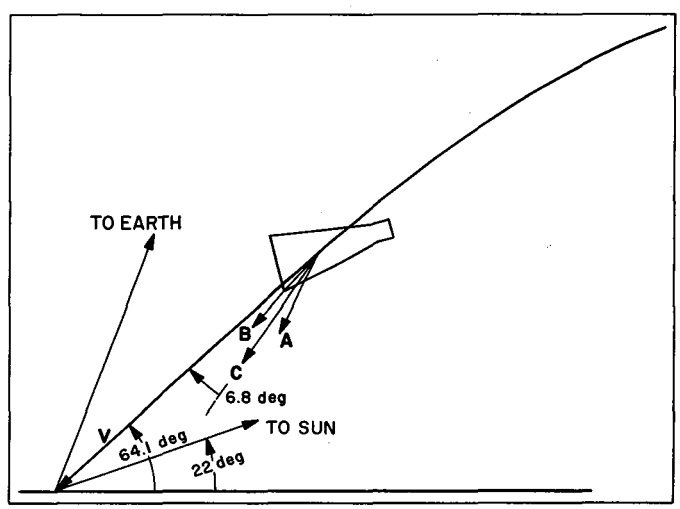
Longitude of impact 20.46 deg West

GMT of impact 31 day 7 mo 64 yr 13 hr 25 min 44 sec

Automatic camera turnon 31 day 7 mo 64 yr 13 hr 9 min 0 sec

Figure 34 depicts the impact geometry with the cameras in the cruise mode orientation. The **C** vector represents the central pointing direction of the four **P** cameras, **A** and **B** represent the pointing directions for the 25 and 8.4 deg field of view **F** cameras. The nominal terminal maneuver, if performed, would have aligned the **C** vector with the impact velocity vector. In the cruise mode the **C** vector was 6.8 deg from the velocity vector, and with the path angle shown of 64.1 deg, an impact velocity of 2.62 km/sec, and a shutter speed of 2 msec, the resultant blurring due to camera motion was 0.8 m. That is, the center of the field of view at the time the shutter closed would be observing a point on the surface 0.8 m away from the point viewed at the time the shutter opened. This is an acceptable level of blur; an amount nine times this figure could probably be tolerated and still meet mission objectives.

Examination of the expected picture quality and coverage obtained with various proposed terminal maneuvers revealed that improvement, if any, would be negligible. Adding to this the consideration of greater reliability by not changing the attitude of the spacecraft, the decision not to perform a terminal maneuver was reached.



34. Approach geometry with no terminal maneuver

C. Comparison of Commanded and Actual Maneuver

This section examines quantitatively the midcourse maneuver execution errors in terms of effective pitch and yaw pointing errors and midcourse motor shutoff errors, and the uncertainties associated with the estimates of these errors.

Using the estimate of the executed maneuver obtained from Section II F 2, the estimated errors may be summarized as follows:

Estimated error in yaw: −2.04 mrad or −0.117 deg

Estimated error in pitch: 0.83 mrad or 0.047 deg

Estimated error in velocity magnitude: − 0.073 m/sec

Mapping these errors to the target results in a miss of 18.0 km in **B · RT** and 17.1 km in **B · TT** and 19 sec in time of flight. The estimated errors compare with the expected standard deviation for the maneuver performed as follows:

$$1 - \sigma_{\text{yaw}} = 7.6 \text{ mrad}$$

$$1 - \sigma_{\text{pitch}} = 3.7 \text{ mrad}$$

$$1 - \sigma_{\text{vel. mag.}} = 0.8 \text{ m/sec}$$

The uncertainties associated with these estimates are 1.29 mrad, 0.19 mrad, and 0.0037 m/sec, respectively.

Some of the errors involved in executing the maneuver may be accounted for in postflight analysis. These errors consist of limit cycle errors in roll, pitch, and yaw, and resolution errors in the roll and pitch commanded and the magnitude of the velocity added. If these identifiable error sources are removed, then the resulting estimate in the errors is as follows:

Estimated error in yaw with identifiable error sources removed: −2.12 mrad (−0.122 deg)

Table 27. Data used in maneuver error computations

	Roll, deg	Pitch, deg	Yaw, deg
Ideal turn	5.563	−86.803	
Resolution error	−0.103	0.053	
Limit cycle error	0.103	0.126	−0.092

Ideal velocity magnitude = 29.7704 m/sec.
Resolution velocity magnitude error = 0.0914 m/sec.
$\bar{V}_E$ (estimated midcourse velocity vector in m/sec) = (−25.063, −15.223, −6.164)

$$\Lambda_V = \begin{bmatrix} 0.31406381E-10 & -0.92115033E-10 & 0.18141402E-9 \\ & 0.32439815E-9 & -0.60889906E-9 \\ & & 0.11959307E-8 \end{bmatrix}$$

Table 28. *Ranger VII* maneuver execution error estimates

	Yaw			Pitch			Velocity, magnitude		
	mrad	deg	ratio to standard deviation	mrad	deg	ratio to standard deviation	m/sec	ratio to standard deviation	
Estimated error	−2.04	−0.117	0.27	0.83	0.047	0.22	−0.073	0.41	All error sources included
Standard deviation of expected error	7.6	0.436	—	3.7	0.212	—	0.18	—	
Estimated error	−2.12	0.122	0.38	3.96	0.227	1.28	−0.082	0.51	All identifiable error sources removed
Standard deviation of expected errors	5.6	0.321	—	3.1	0.178	—	0.16	—	
Standard deviation of the error in the estimate	1.29	0.074	—	0.19	0.011	—	0.0037	—	Applicable to both sets of results

Estimated error in pitch with identifiable error sources removed: 3.96 mrad (0.227 deg)

Estimated error in velocity magnitude with identifiable error sources removed: 0.16 m/sec

Table 27 shows the data used to arrive at all of the results which are then summarized in Table 28.

The estimate of the velocity added at midcourse $\overline{V}_E$, and the covariance matrix of uncertainties Λ_V associated with it were obtained from the best orbit determination. In this estimate of $\overline{V}_E$ tracking data alone were used (no use being made of the spacecraft's maneuver doppler data). (Further details of this orbit appear elsewhere in this Report.) G. D. Pace was the source[11] used for estimating the value of the standard deviation for the pitch and yaw pointing error and for the velocity magnitude error, while estimates for the resolution and the limit cycle errors were obtained from R. E. Hill.[12]

Again, as in *Ranger VI*, the maneuver happened to be initiated near the zero crossing of the roll limit cycle, thus appreciably reducing the chief contribution to the standard deviation of maneuver execution errors.

[11]G. D. Pace, "*Ranger* Block III Midcourse Execution Capabilities," October 10, 1963 (internal communication).

[12]R. E. Hill, "*Ranger* VII Attitude Control Flight Performance," August 7, 1964 (internal communication).

IV. *RANGER VII* TRAJECTORY

A. Launch Phase

Ranger VII was launched from ETR at Cape Kennedy, Florida on Tuesday, July 28, 1964 using an *Atlas D/ Agena B* boost vehicle. Launch occurred at 16:50:07.873 GMT with an inertial launch azimuth of 96.6 deg East of North. After liftoff, the booster rolled to an azimuth of 97.1 deg and performed a programmed pitch maneuver until booster cutoff. During sustainer and vernier stages, adjustments in vehicle attitude and engine cutoff times were commanded as required by the ground guidance computer to adjust the altitude and velocity at *Atlas* vernier engine cutoff. After *Atlas–Agena* separation, there was a short coast period prior to the first ignition of the *Agena* engine. At a preset value of selected velocity increase, the *Agena* engine was cut off. At this time the *Agena*–spacecraft combination were coasting in a nearly circular parking orbit in a southeasterly direction at an altitude of 188 km and an inertial speed of 7.80 km/sec. After an orbit coast time of 19.97 min, determined by the ground guidance computer and transmitted to the *Agena* during the *Atlas* vernier stage, a second ignition of *Agena* engine occurred. Eighty-nine seconds later the *Agena* was cutoff, injecting the *Agena*–spacecraft combination in a nominal Earth–Moon transfer orbit. The launch phase ascent trajectory profile is illustrated in Fig. 35, while a sequence of events from launch to acquisition of the Earth by the spacecraft is shown in Fig. 36.

B. Premaneuver Cruise Phase

Injection (second *Agena* cutoff) occurred at 17:20:01 GMT, over the western coast of South Africa at a geocentric latitude and longitude of −12.89 and 15.07 deg, respectively. The *Agena*–spacecraft were at an altitude of 192 km and traveling at an inertial speed of 10.949 km/sec. One minute and 32 sec after injection the *Agena*–spacecraft combination entered the Earth's shadow. The *Agena* separated from the spacecraft 2 min 35 sec after injection, performed a programmed 180 deg yaw maneuver, and ignited its retrorocket. The retrorocket impulse was designed to eliminate interference with the spacecraft operation and reduce the chance of the *Agena* impacting the Moon. Tracking data indicated that the *Agena* would pass the upper trailing edge of the Moon at an altitude of 3660 km about 3 hr after *Ranger VII* impact.

Ranger VII left the Earth's shadow 40 min 5 sec after injection for a total shadow duration of 38 min 33 sec.

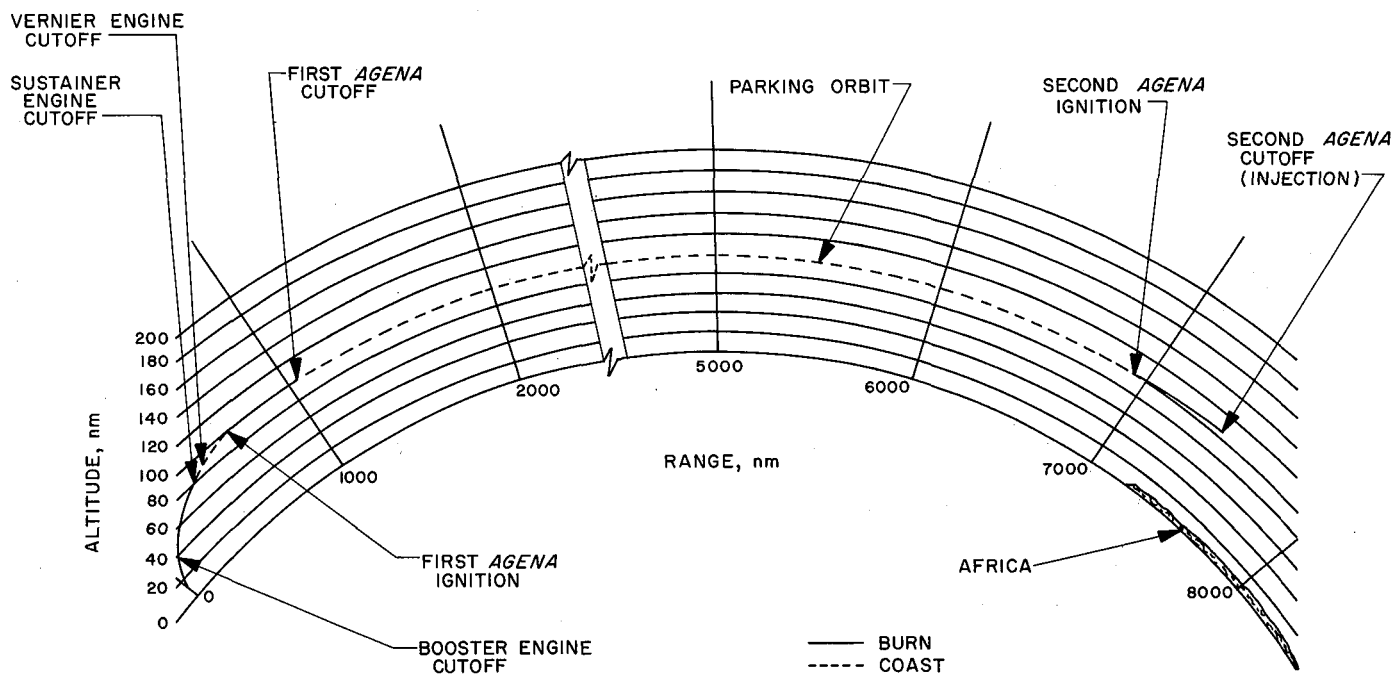


Fig. 35. Ascent trajectory profile

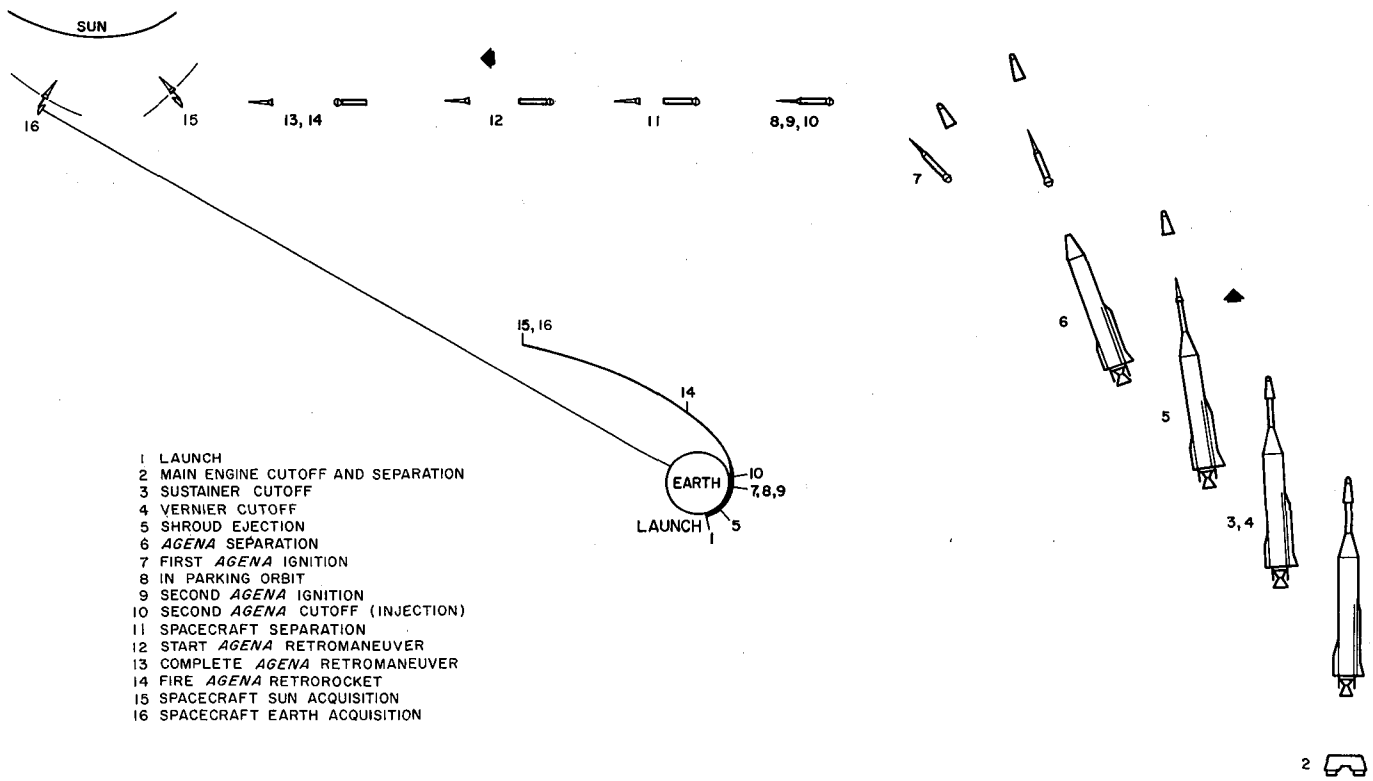


Fig. 36. Sequence of events to Earth acquisition

Sun acquisition had been initiated 9 min 58 sec prior to leaving the Earth's shadow. Five minutes after leaving the Earth's shadow the Sun was acquired. Within an hour after injection, the spacecraft was receding from the Earth in an almost radial direction with decreasing speed. This reduced the geocentric angular rate of the spacecraft (in inertial coordinates) until, at 1.4 hr after injection, the angular rate of the Earth's rotation exceeded that of the spacecraft. This caused the Earth's track of the spacecraft (Fig. 37) to reverse its direction from increasing to decreasing Earth longitude. Plots of geocentric distance and inertial speed for *Ranger VII* as well as Earth–Probe–Sun (EPS), Sun–Probe–Moon (SPM), and Earth–Probe–Moon (EPM) angles as a function of time from launch are presented in Figs. 38 through 40.

Final analysis of premidcourse tracking data showed that without a correction the spacecraft would have impacted the back side of the Moon at a selenocentric latitude and longitude of −12.4 and 201.2 deg, respectively. The transit time from injection to impact would have been 67.396 hr.

C. *Midcourse Maneuver Phase*

In order to alter the trajectory so as to impact a selected aiming point at a selenocentric latitude of −11 deg and longitude of −21 deg, midcourse maneuver calculations indicated a requirement of 29.89 m/sec increment of velocity (60 m/sec maximum capability). In addition, this correction was selected to adjust the flight time from injection to impact to be 68.09 hr, thus allowing the TV camera backup turn on clock to be utilized as designed. To properly align the thrust direction of the midcourse motor for the burn, a +5.56 deg roll turn and −86.80 deg pitch turn were required. The midcourse motor was ignited at 10:27:09 GMT on July 29, 1964 when the spacecraft was at a geocentric distance of 169,000 km and traveling with an inertial speed of 1.786 km/sec relative to Earth. At the end of a 50 sec burn of the midcourse motor, the geocentric distance had increased to 169,075 km, and the inertial speed relative to Earth had decreased to 1.756 km/sec. Analog data received at Goldstone and relayed to the Space Flight Operations Facility (SFOF) at JPL positively indicated that the midcourse maneuver and motor burn had been executed precisely. This was further verified by the observed

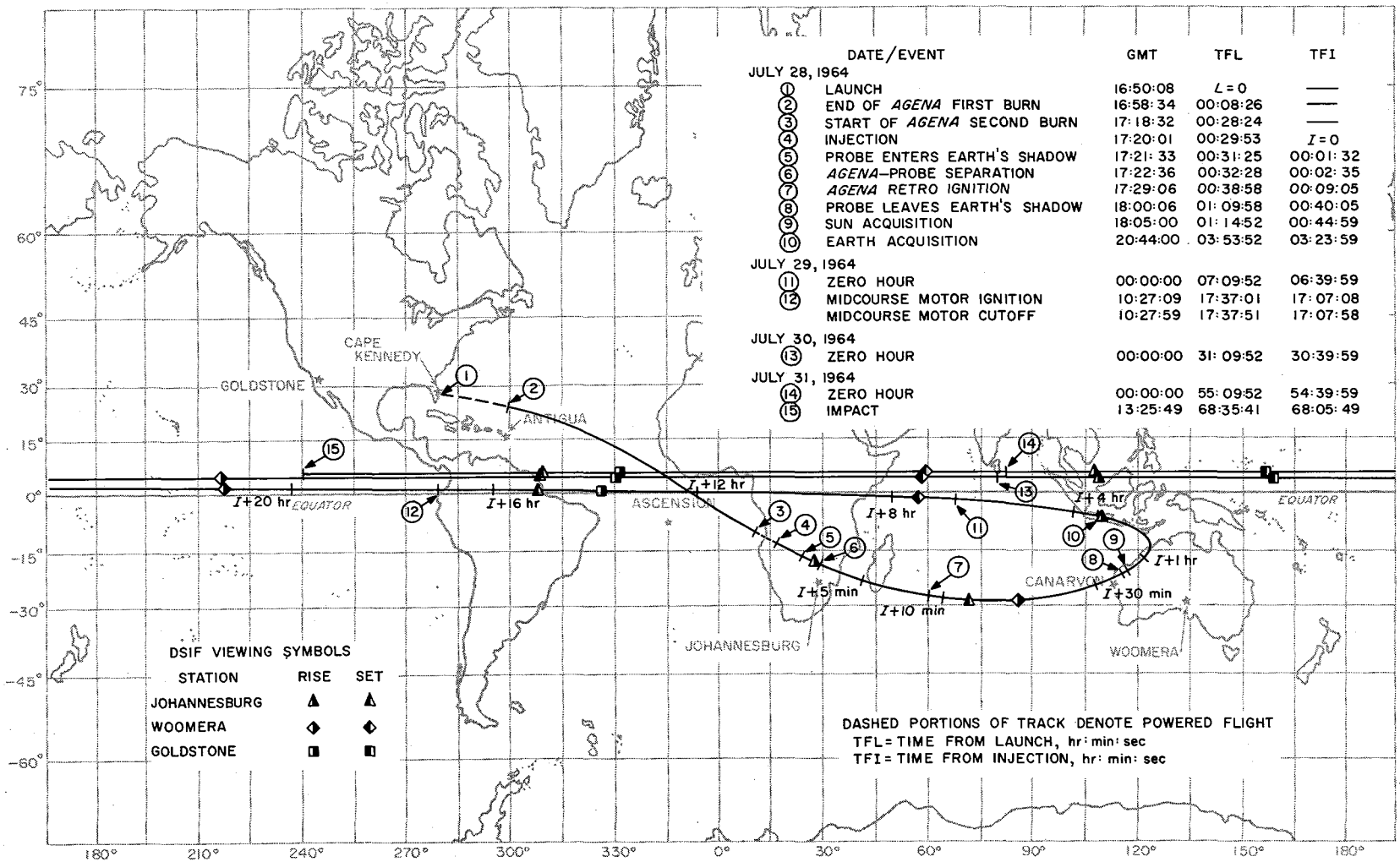


Fig. 37. Date and time chart of significant events

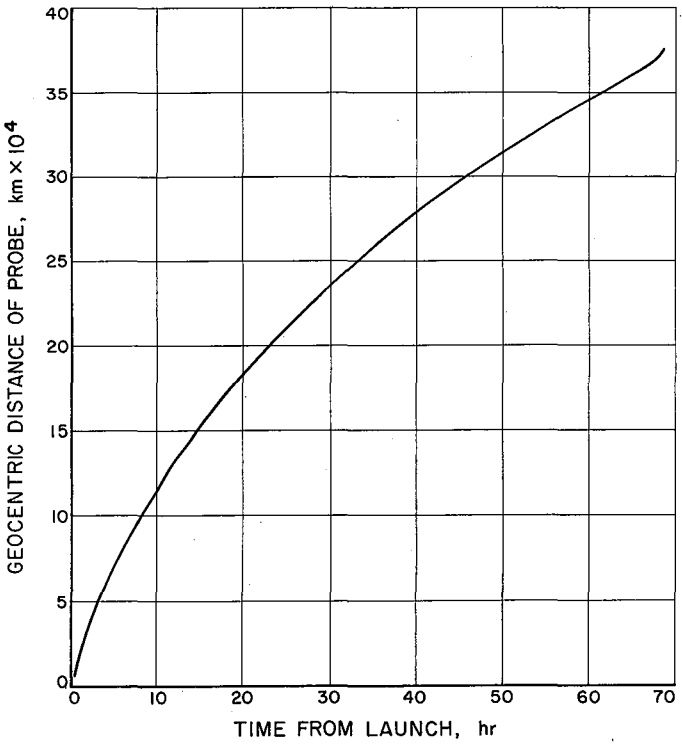


Fig. 38. Probe geocentric radius vs time from launch

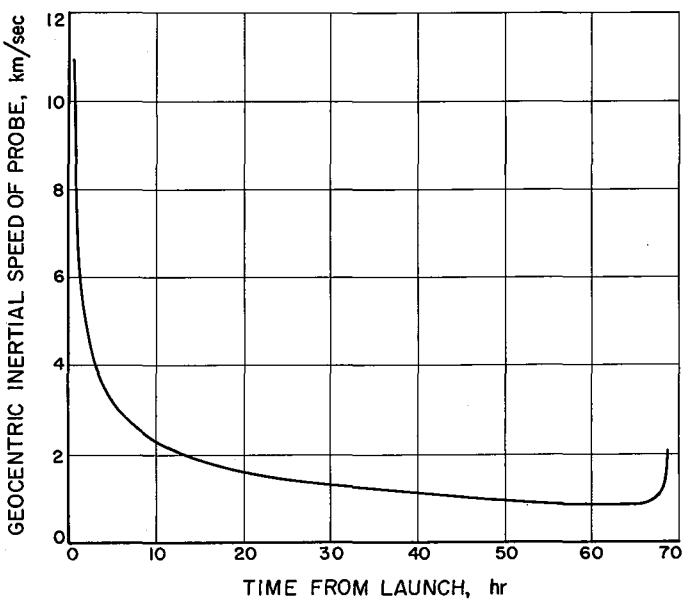


Fig. 39. Probe geocentric velocity vs time from launch

doppler data being essentially the same as those predicted. Injection and encounter conditions for the premidcourse orbit are given in Table 29. Terms used in Table 29 are defined in Table 30.

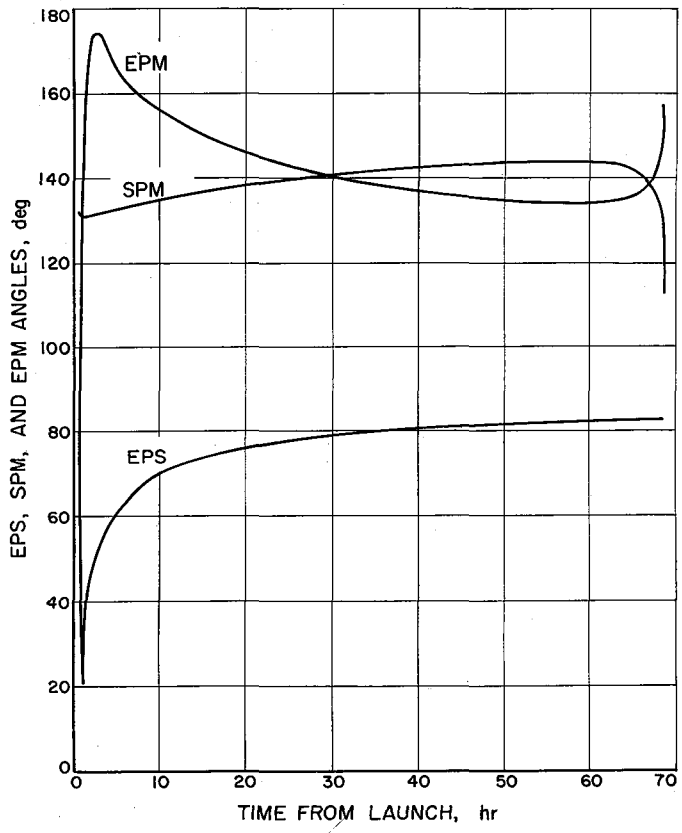


Fig. 40. Earth–probe–Sun (EPS), Sun–probe–Moon (SPM), and Earth–probe–Moon (EPM) angles vs time from launch

D. Postmaneuver Cruise Phase

Following the midcourse maneuver the spacecraft reacquired the Sun and Earth, thus returning to the cruise mode. At about 63 hr after injection and at a geocentric distance of 355,300 km the spacecraft's inertial speed relative to the Earth reached a minimum value of 0.850 km/sec. At this point, the spacecraft was about 28,300 km from the lunar surface with an inertial speed of 1.36 km/sec relative to the Moon. Because of the lunar gravitational field the spacecraft's velocity began to increase.

Postmidcourse tracking data resolved the trajectory's lunar encounter conditions to a high degree of accuracy, with the lunar impact occurring at a selenocentric latitude and longitude of −10.70 and −20.67 deg, respectively, with a flight time of 68.097 hr from injection. The encounter conditions along with the corresponding postmidcourse initial conditions are presented in Table 31. The geocentric spatial trace of the trajectory from injection to impact is illustrated in Fig. 41.

Table 29. *Ranger VII* premidcourse orbit

Initial conditions[a]	
Epoch	July 28, 1964; 17:19:56 GMT
Earth fixed sphericals	
R	6567.6447 km
ϕ	−12.677893 deg
θ	14.648313 deg
V	10.533192 km/sec
γ	1.3797469 deg
σ	117.37653 deg
Inertial Cartesian	
x	−4833.6123 km
y	−4206.2479 km
z	−1441.3998 km
$\dot{x}$	7.0601073 km/sec
$\dot{y}$	−6.8712135 km/sec
$\dot{z}$	−4.7797462 km/sec
Orbital elements	
a	269557.04 km
e	0.97564865
i	28.955996 deg
Ω	17.040849 deg
ω	204.26939 deg
ν	2.6875478 deg
Impact parameters	
Impact epoch	July 31, 1964; 12:43:40.933 GMT
Selenocentric latitude	−12.166318 deg
Selenocentric longitude	203.40645 deg
Time of flight from injection	67.394 hr[b]
B	3873.4142 km[c]
B • **T**[d]	−3801.0655 km
B • **R**[d]	745.14347 km

[a]See Table 30 for definition of terms.

[b]1σ uncertainty of 5.2 sec

[c]1σ uncertainty of 15.9 km

[d]**B** • **T** and **B** • **R** are referenced to the true lunar equator (see Appendix A). For *Ranger VII* work, the true lunar equator is used as the reference plane. If **N** is a unit vector in the lunar North direction, then $\mathbf{T} = \mathbf{S}_I \times \mathbf{N}$ and $\mathbf{R} = \mathbf{S}_I \times \mathbf{T}$.

Table 31. Postmidcourse orbit of *Ranger VII*

Postmidcourse conditions[a]	
Epoch	July 29, 1964; 10:27:58 GMT
Earth-fixed sphericals	
R	169075.12 km
ϕ	2.7383859 deg
θ	277.82480 deg
V	12.070912 km/sec
γ	8.1207516 deg
σ	270.95862 deg
Inertial Cartesian	
x	156674.52 km
y	63041.633 km
z	8077.6773 km
$\dot{x}$	1.4342616 km/sec
$\dot{y}$	0.97257020 km/sec
$\dot{z}$	0.28116151 km/sec
Orbital elements	
a	244087.05 km
e	0.97401691
i	28.707653 deg
Ω	16.908152 deg
ω	203.78266 deg
ν	161.92552 deg
Impact parameters	
Impact epoch	July 31, 1964; 13:25:48.724 GMT
Selenocentric latitude	−10.701742 deg
Selenocentric longitude	−20.66861 deg
Time of flight from injection	68.0966 hr[b]
B	1811.9285 km[c]
B • **T**[d]	1623.9736 km
B • **R**[d]	803.61342 km

[a]See Table 30 for definition of terms.

[b]1σ uncertainty of 1.0 sec

[c]1σ uncertainty of 14.7 km

[d]**B** • **T** and **B** • **R** are referenced to the true lunar equator (Appendix A). For *Ranger VII* work, the true lunar equator is used as the reference plane. If **N** is a unit vector in the lunar North direction, then $\mathbf{T} = \mathbf{S}_I \times \mathbf{N}$ and $\mathbf{R} = \mathbf{S}_I \times \mathbf{T}$.

Table 30. Definition of terms

Parameter	Definition (Earth as central body)
R	Probe radius distance, km
ϕ	Probe geocentric latitude, deg
θ	Probe East longitude, deg
V	Probe Earth-fixed velocity, km/sec
γ	Path angle of the probe Earth-fixed velocity vector with respect to the local horizontal, deg
σ	Azimuth angle of the probe Earth-fixed velocity vector measured East of true North, deg
x, y, z	Vernal equinox Cartesian coordinates in a geocentric equatorial system. The origin is the center of the central body. The principal direction (x) is the vernal equinox direction of date, and the principal plane (x, y) is the Earth equatorial plane of date. z is along the direction of the Earth's spin axis of date, km
$\dot{x}, \dot{y}, \dot{z}$	First time derivatives of x, y, and z, respectively, i.e., Cartesian components of the probe space-fixed velocity vector, km/sec
a	Semimajor axis, km
e	Eccentricity
i	Inclination, deg
Ω	Longitude of the ascending node, deg
ω	Argument of pericenter, deg
ν	True anomaly, deg

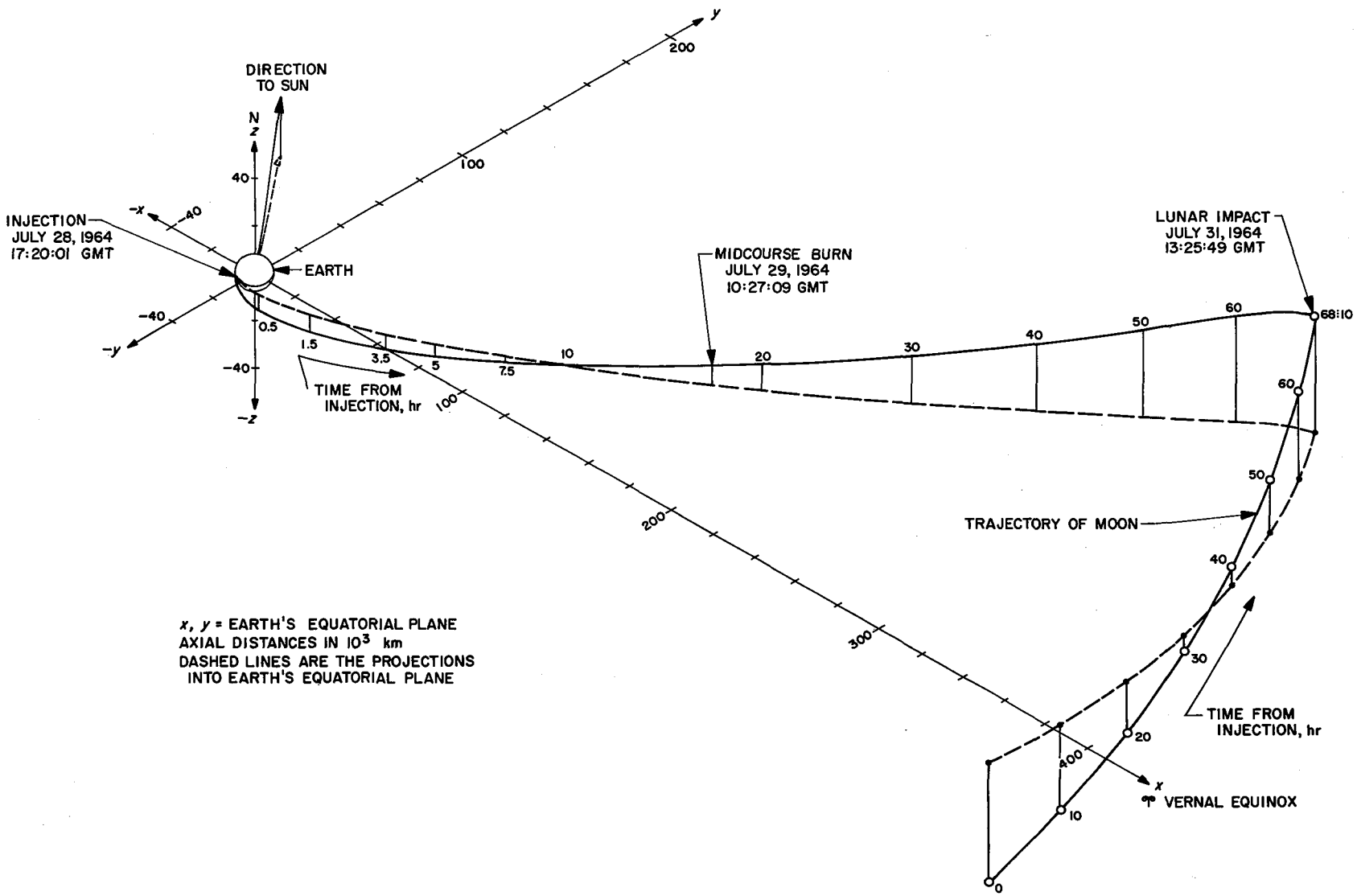


Fig. 41. Geocentric spatial trace *Ranger VII* trajectory

E. Encounter Phase

During the encounter phase the spacecraft raced toward impact with increasing acceleration due to the pull of the lunar gravity field. This effect is shown in Fig. 42 in which the *Ranger VII* trajectory trace to lunar encounter is compared with a hypothetical *Ranger VII* trajectory resulting from a massless Moon. One hour before impact, the speed of the probe relative to the Moon had increased to 1.551 km/sec and was at a lunar altitude of 6390 km. No terminal maneuver was needed at this time to realign the TV cameras' pointing direction.

About 45.5 min before impact, the spacecraft crossed the lunar equator at an altitude of 4933 km. At 13:08:36 GMT at 2126 km above the lunar surface, F channel full power was verified. At 13:12:09 GMT and at 1723 km, P channel full power was also verified. Minutes later at 13:25:50 GMT on July 31, 1964, *Ranger VII* crashed into what was to be named the lunar "Mare Cognitum" at an impact speed of 2.616 km/sec and at a path angle of −64.1 deg. The spacecraft had encountered the Moon in a direct motion along a hyperbolic trajectory with the incoming asymptote direction at an angle of −5.57 deg to the lunar equator, and the orbit plane inclined 26.84 deg to the lunar equator.

The trace of the trajectory on the lunar surface from injection to impact is given in Fig. 43, while the traces of the lunar approach portions of the premidcourse and postmidcourse orbits are illustrated in Fig. 44. The probe's geocentric distance and velocity are given in Figs. 45 and 46, respectively, for the last few hours of flight. The selenocentric altitude and velocity are given in Figs. 47 and 48, and the EPS, SPM and EPM angles for the last hours of flight are in Fig. 49.

A study of the *Ranger VII* trajectory can be made by examining the detailed trajectory printout (Appendixes B and C). Appendix B contains the trajectory listing for the premidcourse orbit from the initial epoch to the midcourse epoch and a lunar impact printout. Appendix C contains the trajectory listing for the postmidcourse orbit from midcourse to lunar encounter. Appendix D, Table D-1, is a key to the trajectory printout. Table D-2 contains the definitions of the trajectory printed quantities. Constants and conversion factors used in *Ranger VII* trajectory computation are listed in Table D-3. The miss parameter **B**, used to measure the miss distance for the lunar trajectory, is defined in Appendix A.

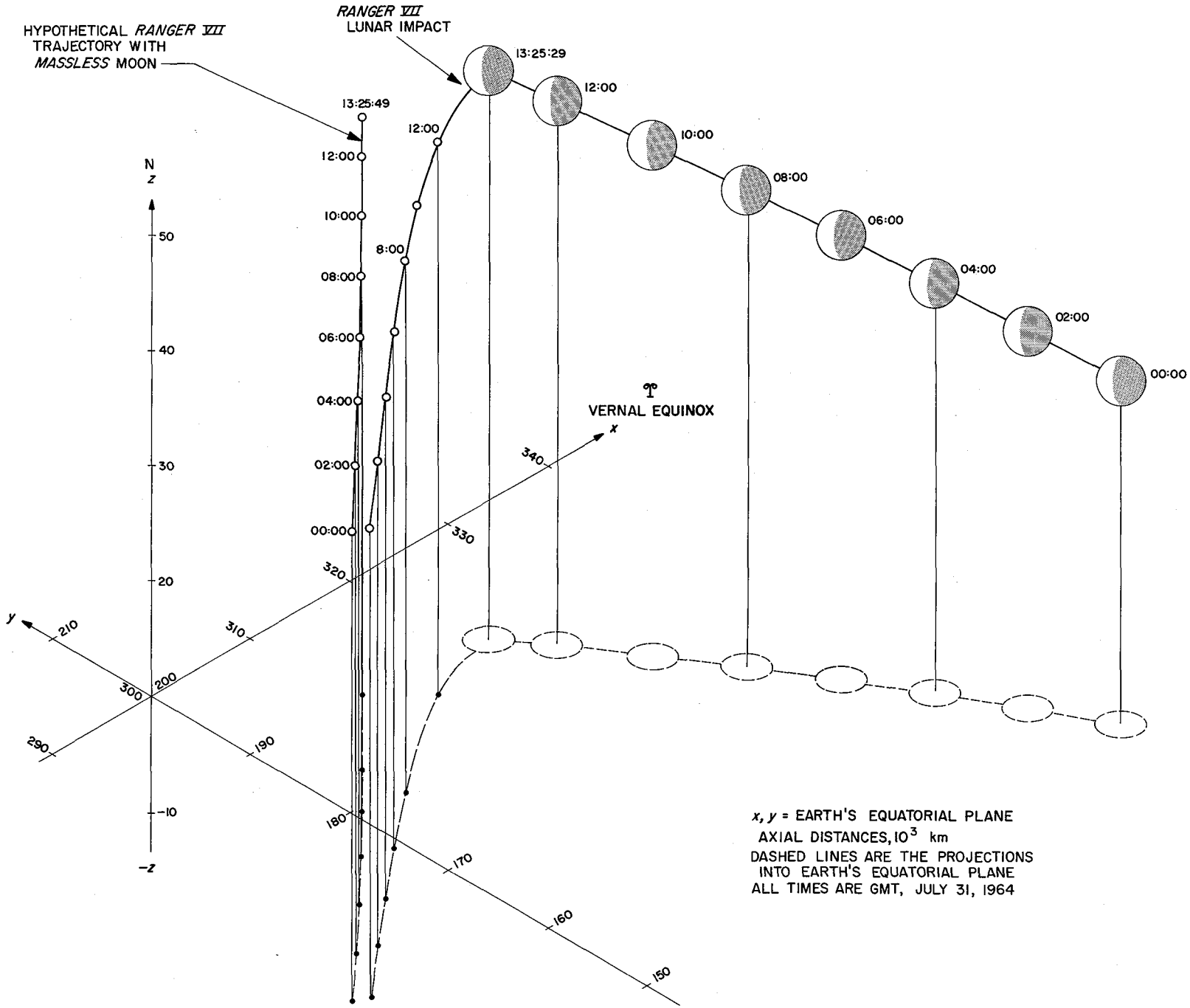


Fig. 42. Lunar gravitational effect on *Ranger VII* trajectory near encounter

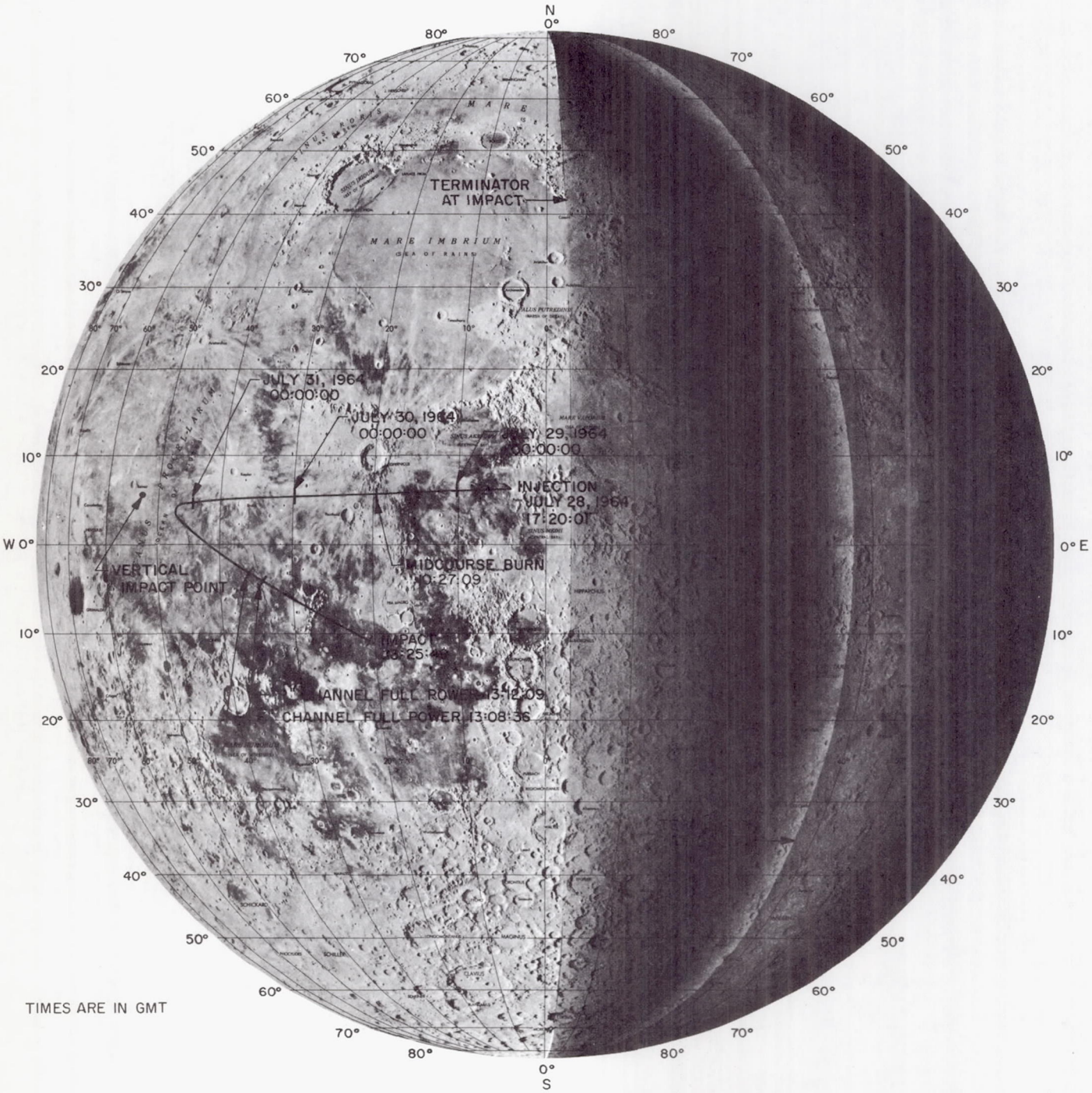


Fig. 43. Trace of *Ranger VII* trajectory on the lunar surface

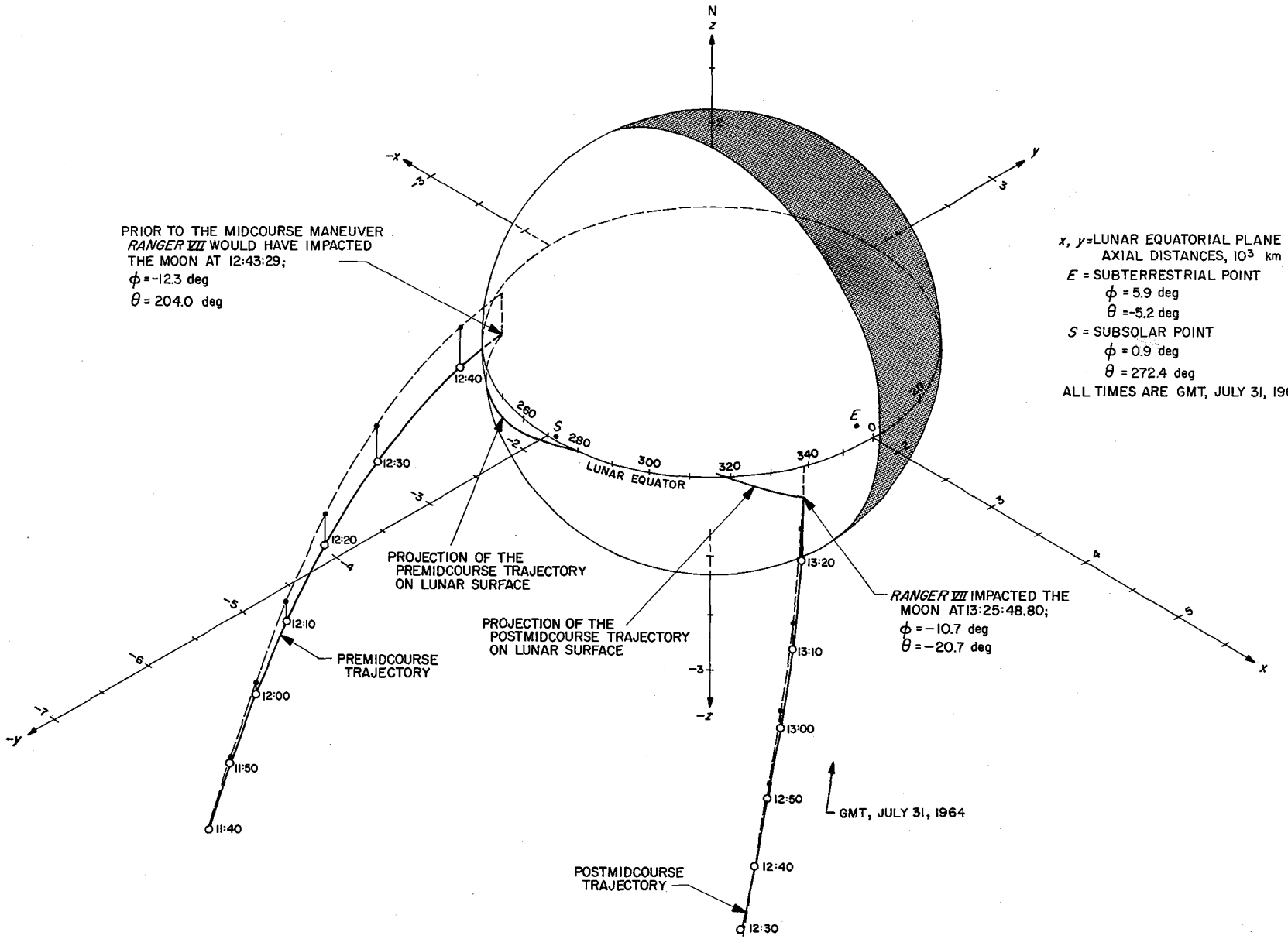
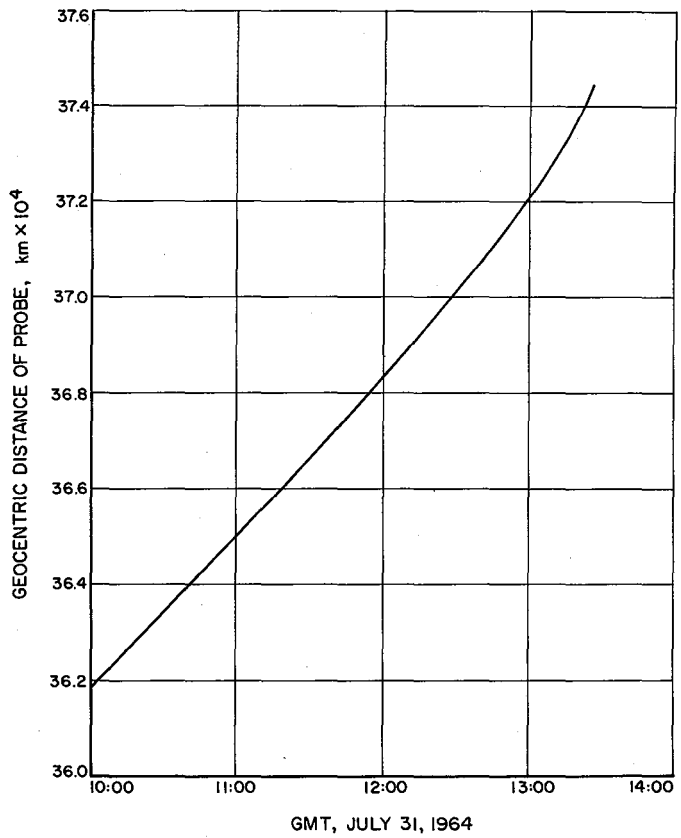
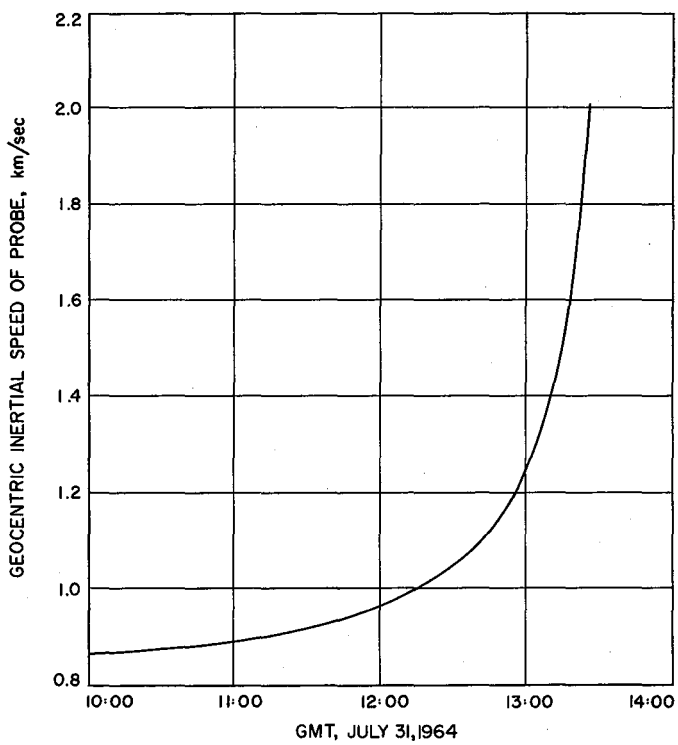


Fig. 44. Traces of lunar trajectory for premidcourse and postmidcourse orbits



← Fig. 45. Geocentric distance of probe vs GMT at lunar encounter



← Fig. 46. Geocentric inertial speed of probe vs GMT at lunar encounter

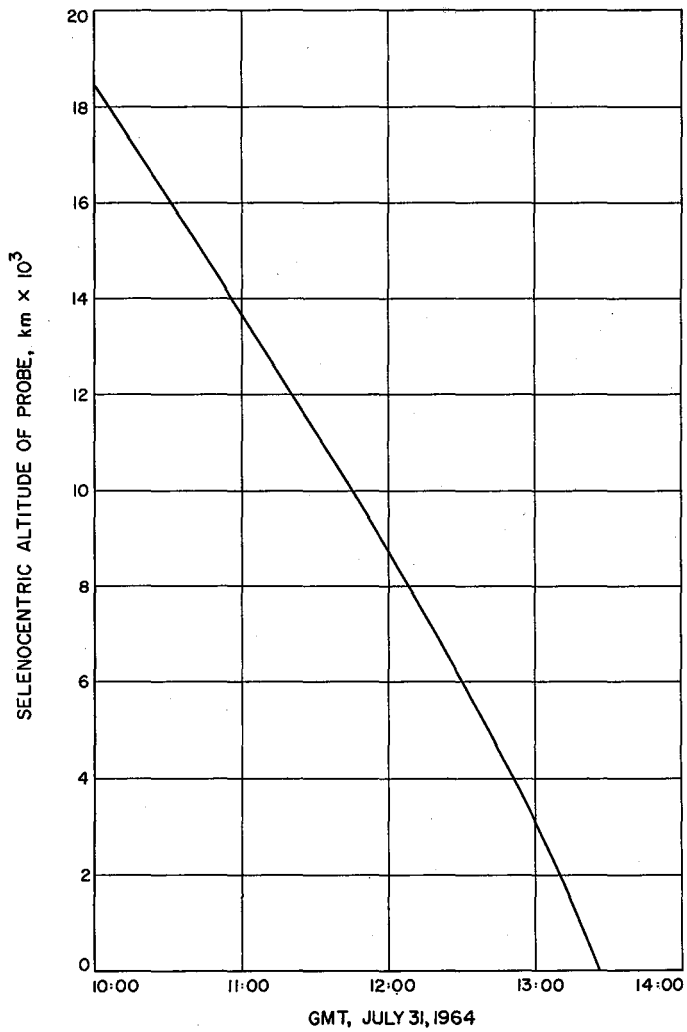


Fig. 47. Selenocentric altitude of probe vs GMT at lunar encounter

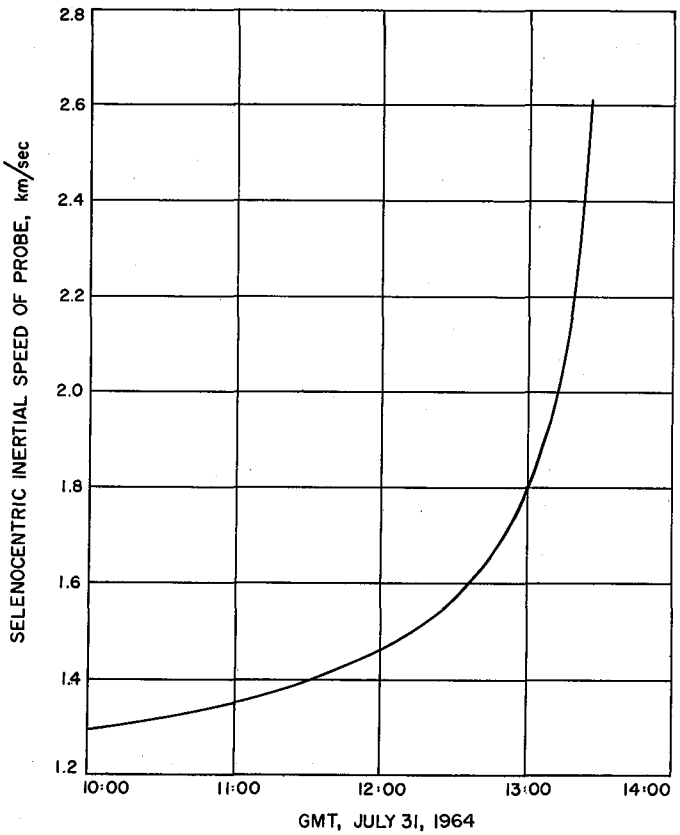


Fig. 48. Selenocentric inertial speed of probe vs GMT at lunar encounter

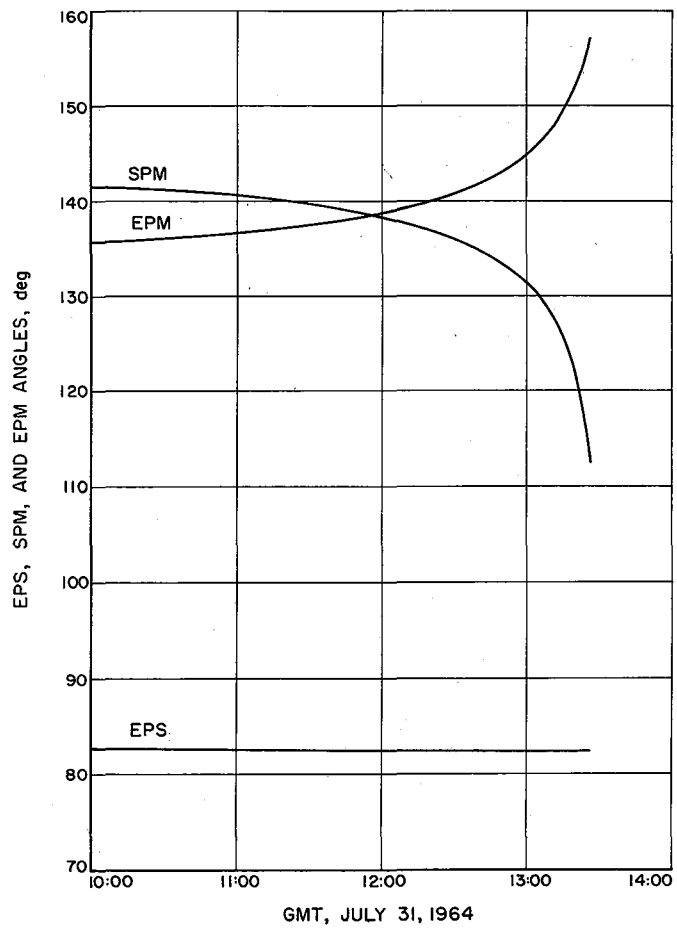


Fig. 49. Earth–probe–Sun (EPS), Sun–probe–Moon (SPM), and Earth–probe–Moon (EPM) angles vs GMT at lunar encounter

V. ANALYSIS OF AIR FORCE EASTERN TEST RANGE TRACKING DATA

A. Introduction

For the *Ranger* missions, the AFETR is responsible for providing classical orbital elements for both the parking and transfer orbits, and for providing initial acquisition information to the DSIF tracking stations. These calculations are performed on an IBM 7094 computer located at AFETR using *Agena* vehicle tracking data obtained from the downrange AFETR tracking stations. Results of these calculations are transmitted to the JPL SFOF in Pasadena. The acquisition information is relayed to the DSIF stations, and the initial orbital elements are used in the JPL orbital calculations.

In addition to fulfilling these requirements, AFETR transmits tracking data obtained during the parking orbit, transfer orbit, and *Agena* postretro orbit to the SFOF. The parking orbit data are very useful for detecting nonstandard flight conditions, and the transfer orbit data are used during flight operations to verify the initial orbital estimates based on DSIF data. *Agena* postretro data are important for verifying *Agena* retrofiring, and are further used to establish the *Agena* vehicle postretro orbit.

During this mission, AFETR stations tracked the *Ranger VII Agena* vehicle from launch until it was lost by Pretoria 8 min after *Agena* retrofiring. Additional tracking data were supplied by two National Aeronautics and Space Administration (NASA) stations located at Bermuda and Carnarvon, Australia. The names, locations, and radar types for the AFETR and NASA stations are given in Table 32. Table 33 summarizes the tracking data coverage provided by these stations.

Table 32. AFETR and NASA station locations[a]

Station name	Controlling agency	Latitude deg	Longitude deg	Radar type
Antigua	AFETR	17.0 N	298.2 E	FPQ-6
Ascension	AFETR	7.9 S	345.6 E	FPS-16
Bermuda	NASA	32.2 N	295.3 E	FPS-16
Carnarvon	NASA	24.7 S	113.7 E	FPQ-6
Pretoria	AFETR	25.8 S	28.3 E	FPS-16

[a] See Ref. 16.

B. Acquisition Information

Twenty-four minutes of initial acquisition information was provided for DSIF Stations 41, 51, and 59, based on the actual parking orbit and nominal second *Agena* burn. Shortly after injection, this information was updated for 100 min, based on the actual transfer orbit. These predictions included pointing angles, receiver doppler detector output for both one-way and two-way doppler, and the ground station transmitter reference frequency required to establish uplink lock with the spacecraft. A comparison between the AFETR predicted pointing angles and the actual tracking angles showed that the predicted values were well within the beam width of all station antennas.

Table 33. Tracking station data coverage

Station name	Mission phase	Start data			End data			Maximum elevation, deg	Number of data points
		GMT	Range, km	Elevation, deg	GMT	Range, km	Elevation, deg		
Bermuda	Parking orbit	16:58:42	905	8.0	17:01:12	1,656	1.2	8.0	26
Antigua	Parking orbit	17:00:00	950	7.2	17:02:48	1,600	0.0	7.2	28
Ascension	Parking orbit	17:11:12	1424	1.4	17:15:30	1,281	0.0	4.0	44
Pretoria	Preretro orbit	17:21:30	1245	6.3	17:29:06	3,683	9.8	27.2	74
Pretoria	Postretro orbit	17:29:12	5421	9.6	17:37:06	7,761	1.1	9.6	77
Carnarvon	Postretro orbit	17:35:12	5161	22.4	18:04:48	11,153	88.1	88.1	241

C. *Analysis of Parking Orbit Data*

In the parking orbit phase, angular and range data were obtained by Antigua, Ascension and Bermuda. During flight operations, only Antigua data were used for the parking orbit calculation made at JPL. Numerical values for the parameters in this solution are given in Table 34, column 3. These values are in good agreement with orbital elements obtained from the AFETR solution seen in column 2, except for Ω (longitude of ascending node) and ω (argument of pericenter passages). Table 35 shows the number of data points and associated statistics for this calculation. The residuals, observed minus computed, may be seen in Fig. 50.

For the postflight analysis an orbital estimate was made using data from Ascension and Bermuda only. The data points used and the associated statistics are given in Table 36. Bermuda angular data were not used for this calculation, and it was necessary to correct the ranging data values to account for range reference oscillator timing errors.[13] The number of points and the associated statistics are given in Table 36, and the residual plots may be seen in Figs. 51 and 52. Parameter values, given in Table 34, column 4, show good agreement with the two real-time orbital solutions seen in columns 2 and 3 of the Table. The solutions for argument of pericenter passage do not appear consistent. However, this parameter is not well defined for this orbit due to the near zero values for both the eccentricity e and path angle γ_0. Using these data, the latitude and longitude of the Bermuda tracking station were determined. This solution

Table 34. Parking orbit parameter solutions (Epoch = 16 hr 58 min 32.00 sec)

Orbital parameter	Orbit reported by ETR[a] (2)	Real time orbit[b] (3)	Post analysis orbit[c] (4)
R_o, km	6561	6559.7937	6560.7722
Φ_o, deg	24.660	25.031393	25.035432
λ_o, deg	299.336	297.90737	297.91529
V_o, km/sec	7.386	7.3827313	7.3820695
γ_o, deg	−0.002	0.038837308	−0.028649228
σ_o, deg	106.315	105.64363	105.633888
a, km	6575.9	6572.9758	6570.5272
C	0.002372	0.001467387	0.0015632628
i, deg	28.826	28.854379	28.828694
Ω, deg	16.980	16.194773	16.989216
ω, deg	120.906	20.027	136.34901
C_3, km/sec^2	−60.62	−60.64	−60.66

[a]Epoch from ETR = 16 hr 58 min 52.9 sec. Orbit based on best data set(s) selected from various tracking stations.

[b]Orbit from Antigua data only (calculated at JPL).

[c]Orbit from Bermuda and Ascension (calculated at JPL).

Note: the ETR orbit is received prior to obtaining the solution shown in column 3.

Table 35. Inflight parking orbit data statistics

Station name	Data type	Number of points used	Standard deviation	Mean
Antigua	Range, m	15	5	16.1
	Azimuth, deg	23	0.0080	0.0000
	Elevation, deg	23	0.0437	0.0202

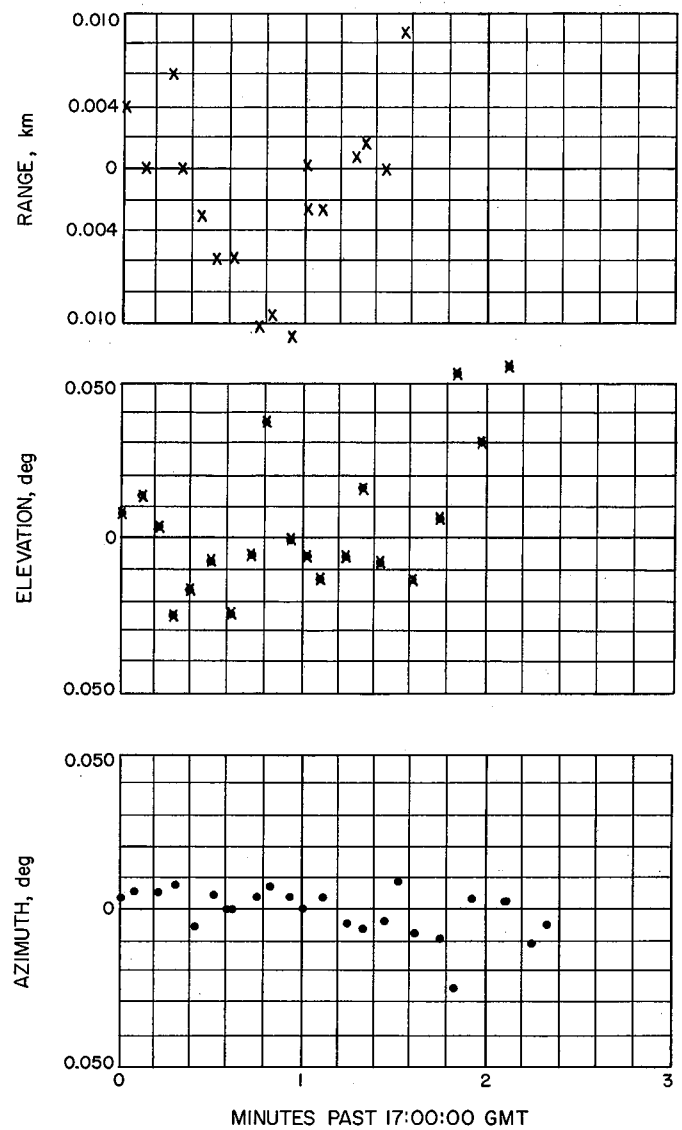


Fig. 50. Antigua parking orbit residuals

[13]This type of error is apparently a characteristic of the C-band pulse radar systems used by these AFETR and NASA stations (Ref. 16).

Table 36. Postflight parking orbit data statistics

Station name	Data type	Number of points used	Standard deviation	Mean
Bermuda	Range, m	20	16	2.85
Ascension	Range, m	32	7	1.53
	Azimuth, deg	32	0.0187	0.0000
	Elevation, deg	31	0.0185	0.0031

shows good agreement with the solution obtained during the *Ranger VI* mission. These results may be seen in Table 37.

When a combined orbital calculation was made using data from all three stations, the Antigua data appeared to be somewhat inconsistent with the data from the other two stations. This is still being investigated.

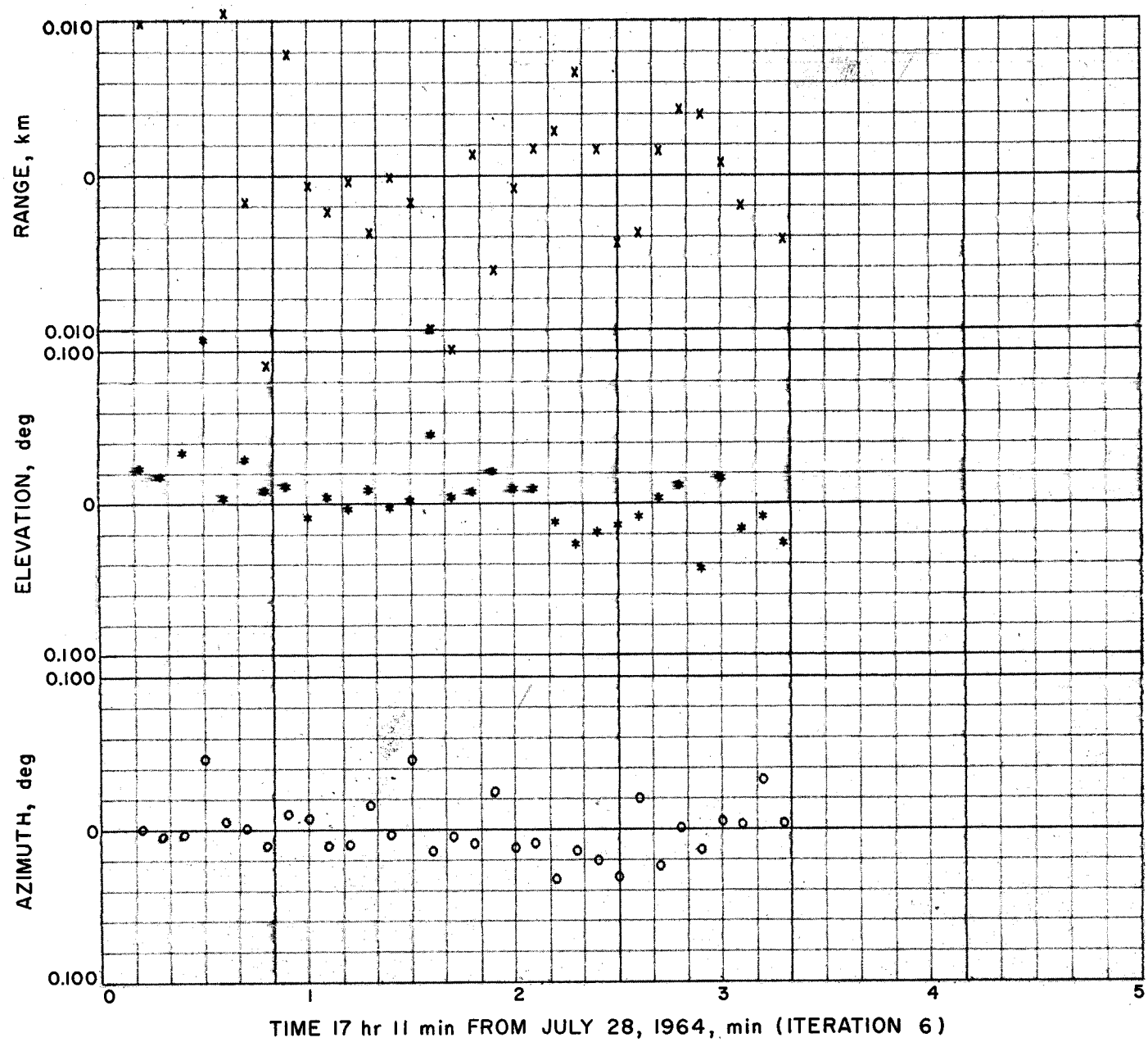


Fig. 51. Ascension Island parking orbit residuals

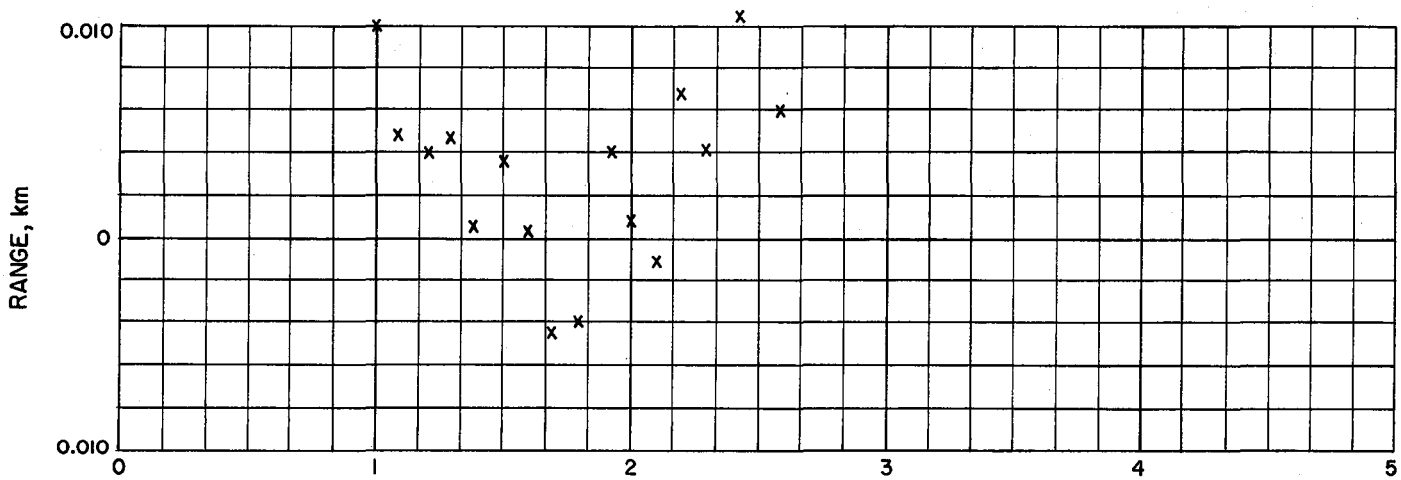


Fig. 52. Bermuda parking orbit residuals

Table 37. Bermuda station coordinate solutions

Coordinate	Nominal value[a]	*Ranger VI* solution, deg	*Ranger VII* solution, deg	*Ranger VI*—*Ranger VII*, deg
Latitude	32.1709	32.170257 ± 0.0004	32.177880 ± 0.0129	−0.00752
Longitude	295.3465	295.34705 ± 0.0007	295.35219 ± 0.0108	−0.00514

[a]See Ref. 16.

Table 38. Transfer orbit and postretro *Agena* retro orbit parameter solutions (Epoch = 16 hr 19 min 56 sec)

Orbital parameter	DSIF orbit	ETR orbit (Pretoria)	ETR postretro orbit (Pretoria)
R_o, km	6567.6442	6567.4832	6566.0807
Φ_o, deg	−12.677881	−12.675307	−12.738016
λ_o, deg	14.648304	14.645455	146.90039
V_o, km/sec	10.533192	10.533181	10.520717
γ_o, deg	1.3797452	1.3787070	1.4308913
σ_o, deg	117.37655	117.36825	−117.32460
a, km	269557.25	269050.88	223732.21
e	0.97564866	0.97560342	0.97066925
i, deg	28.956008	28.947857	28.935328
Ω, deg	17.0450877	17.034816	16.935673
ω, deg	204.26936	204.27300	204.31778
C_3, (km/sec)^2	−1.4787266	−1.4815107	−1.7816077

Table 39. Preretro orbit data statistics

Station name	Data type	Number of points used	Standard deviation	Mean
Pretoria	Range, m	47	10	1.07
	Azimuth, deg	65	0.0082	0.0000
	Elevation, deg	65	0.0091	−0.00381

D. *Analysis of Agena Preretro Transfer Orbit Tracking Data*

Preretro tracking data were received from Pretoria from 17:21:30 to 17:29:06 GMT July 28. These data were used during flight operations to determine the *Agena* transfer orbit. This solution agreed very well with the transfer orbit solution previously reported by AFETR. In addition, portions of the Pretoria data were used in the JPL orbital calculations to verify the initial orbit estimates based on DSIF data.

In the postflight analysis, a comparison between the best postflight estimate of the premaneuver orbit based on DSIF data only and the estimate based on the Pretoria data showed the two solutions to be in remarkably good agreement. The values of the parameters for these solutions may be seen in Table 38, columns 2 and 3. Tracking data statistics for the Pretoria estimate are given in Table 39, and the residual plots may be seen in Figs. 53 and 54.

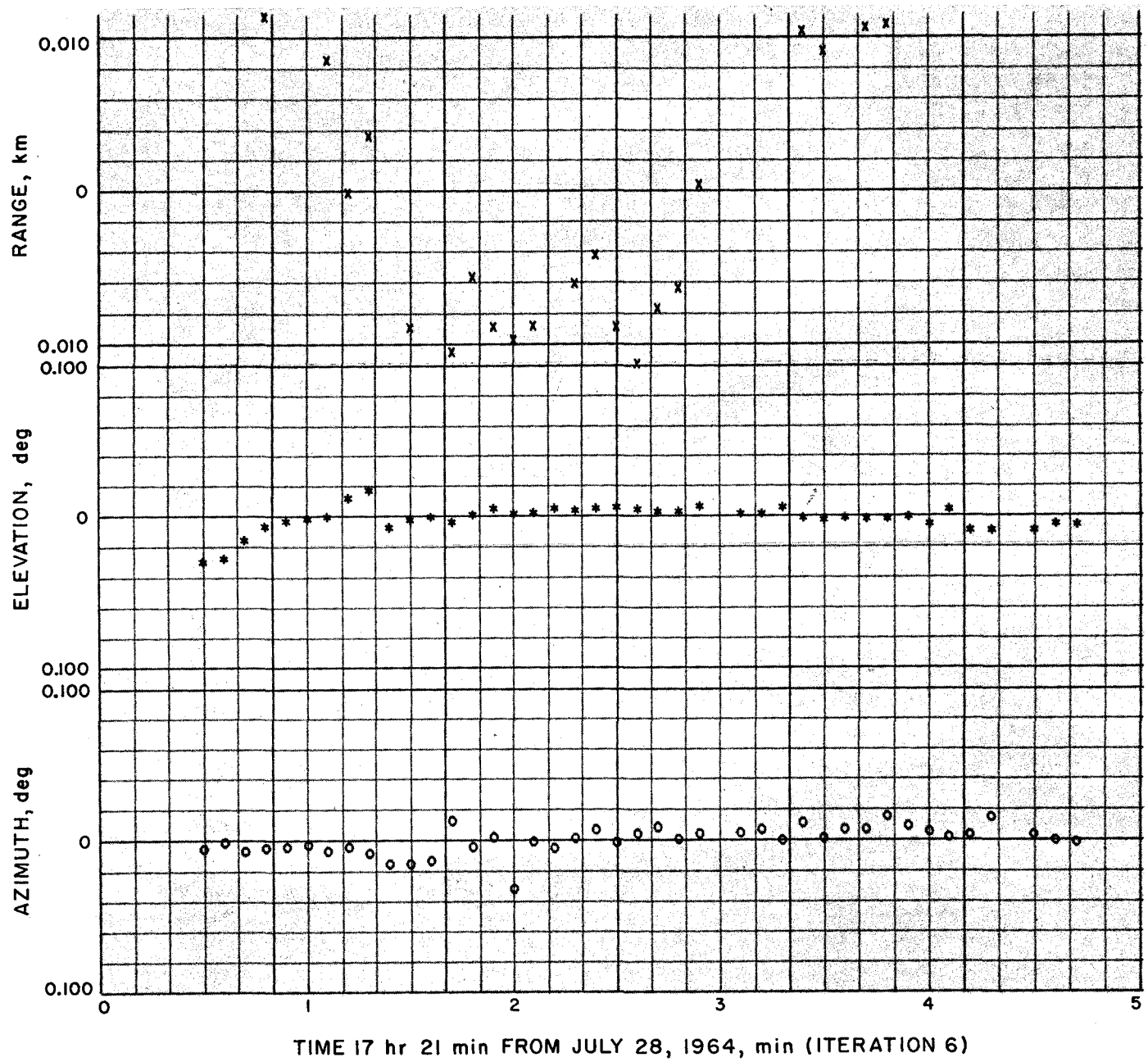


Fig. 53. Pretoria preretro residuals (start 17:21 GMT)

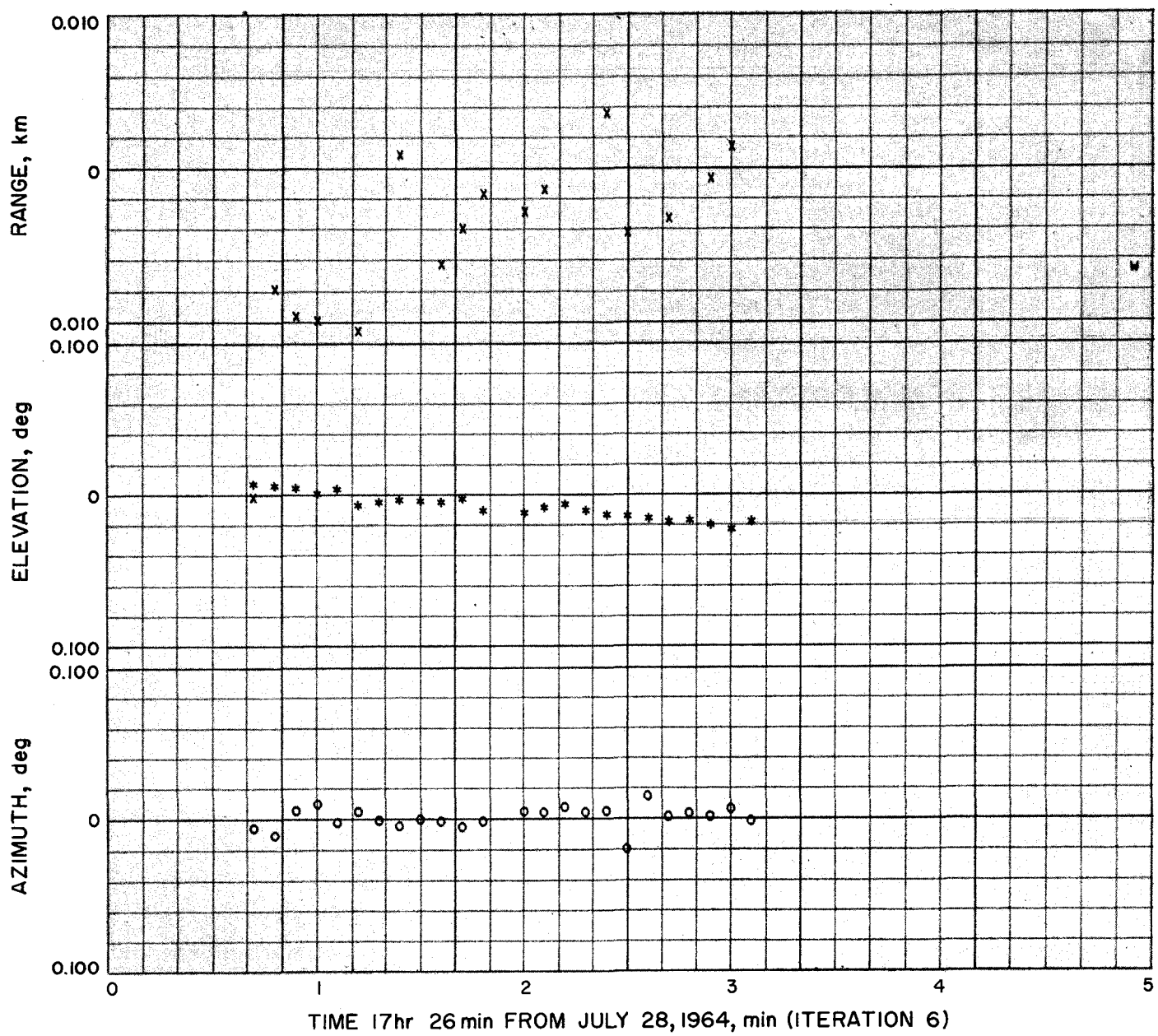


Fig. 54. Pretoria preretro residuals (start 17:26 GMT)

E. Analysis of Agena Postretro Tracking Data

Agena postretro tracking data were received from Pretoria and Carnarvon. An estimate of the *Agena* postretro orbit was made using only Pretoria data. This solution revealed that the *Agena* vehicle would miss the Moon's surface by 3660 km and go into a heliocentric orbit. Parameter values for this estimate are given in Table 38, column 4. The number of points and associated statistics are given in Table 40, and the residual plots may be seen Figs. 55 and 56.

Table 40. Postretro orbit data statistics

Station name	Data type	Number of points used	Standard deviation	Mean
Pretoria	Range, m	25	38	1.17
	Azimuth, deg	45	0.0143	0.0000
	Elevation, deg	45	0.0299	−0.0150

A combined estimate based on both Pretoria and Carnarvon data has not yet been satisfactorily made (apparently due to an error in the station coordinates at Carnarvon). The Carnarvon data appeared to be relatively noise free, but a good estimate of the data accuracy is not possible at this time.

F. Conclusions

The Pretoria tracking data were very useful during flight operations for verifying the initial orbit estimates based on DSIF data. It is anticipated that these data will be more fully utilized in conjunction with the DSIF data as continued confidence is obtained from flight experience.

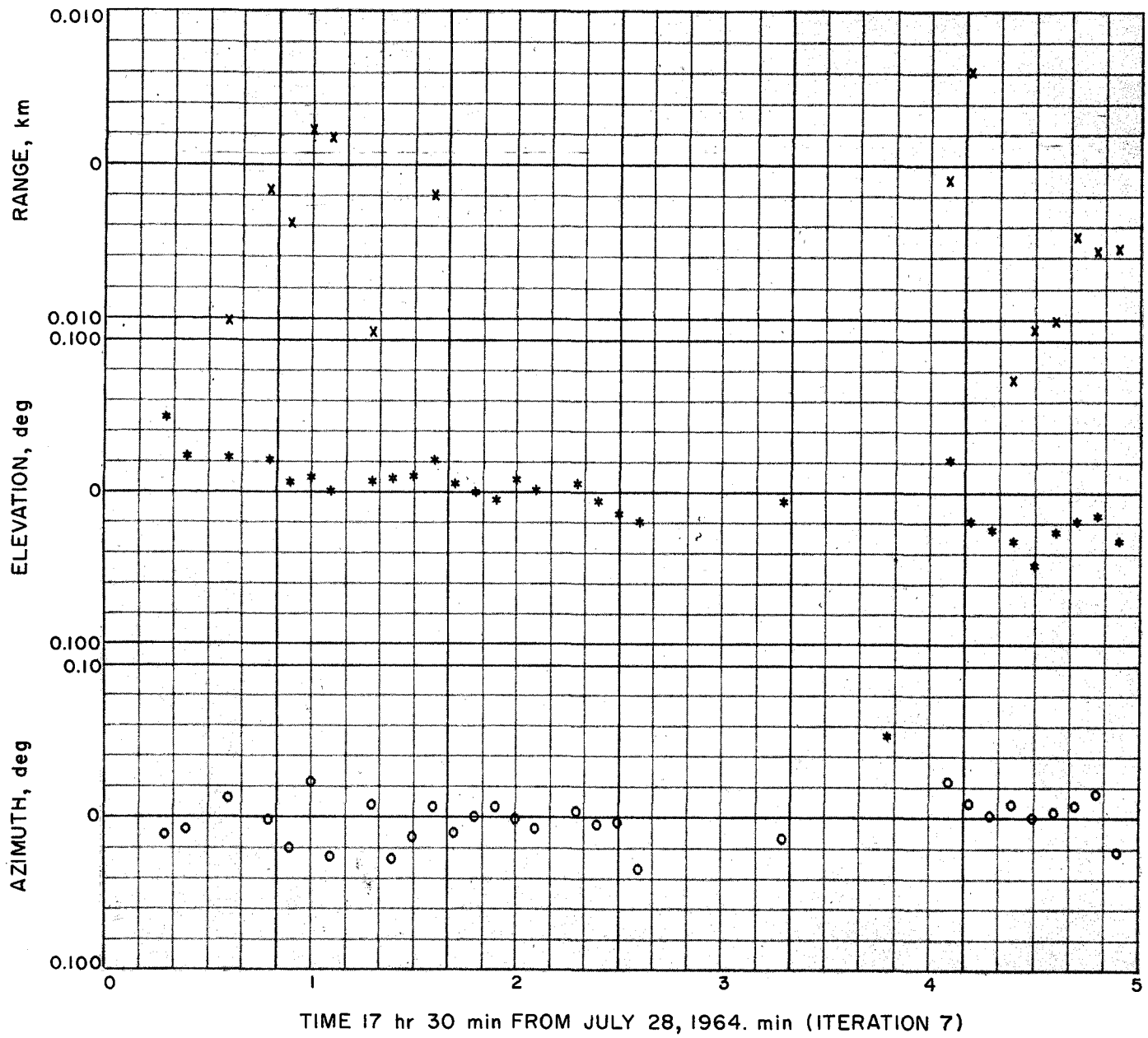


Fig. 55. Pretoria postretro residuals (start 17:30 GMT)

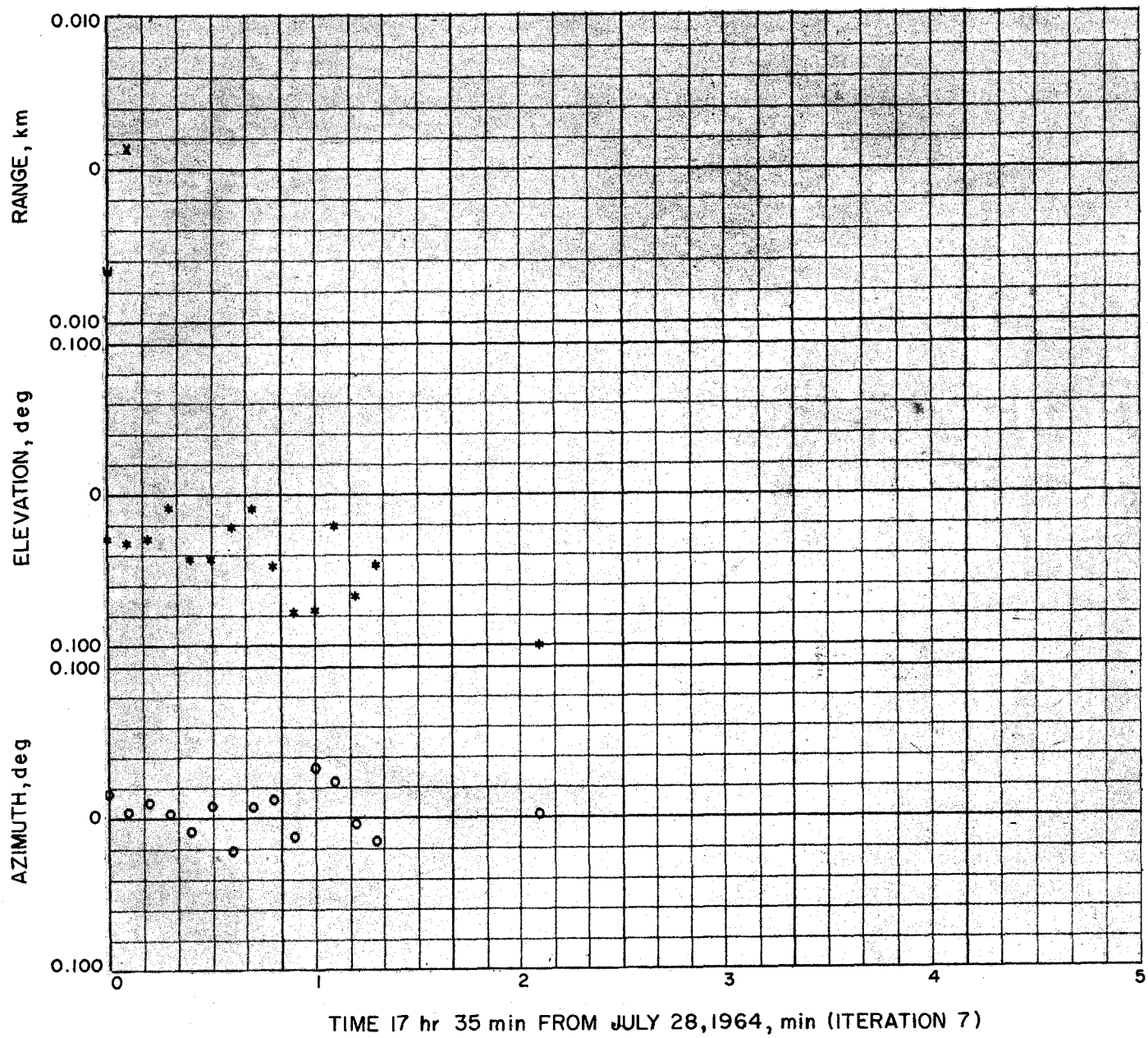


Fig. 56. Pretoria postretro residuals (start 17:35 GMT)

VI. DEEP SPACE INSTRUMENTATION FACILITY TRACKING OF *RANGER VII*

A. General Information

The DSIF is primarily composed of various tracking stations located around the world and interfaces which connect these tracking stations with the main control center at JPL. The names and locations of the DSIF stations employed in the *Ranger VII* mission are given in Table 41. Since Station 71, located at Cape Kennedy, does not obtain postinjection tracking data, it is not listed in Table 41. This station performs the vital task of prelaunch checkout of the spacecraft radio, telemetry, and TV systems. It also provides spacecraft frequencies to the Tracking Data Analysis Group at the SFOF for use in computing acquisition predictions. Detailed characteristics of the stations are available elsewhere.[14]

Table 42 shows the nominal view periods of the spacecraft to the DSIF stations during the course of the mission. Rise and set times (in GMT) refer to that time at which the spacecraft is at a 5-deg geometrical elevation angle. Since the spacecraft signal can frequently be received when the spacecraft is lower than 5 deg, it is possible that acquisition of the spacecraft will occur before nominal rise time and loss of signal after nominal set time. The modes of operation of the DSIF are identified as ground modes (GM) and can be seen in Table 43.

[14]Jet Propulsion Laboratory, *Space Flight Operations Plan, Ranger VII*, May 28, 1964 (internal communication).

Table 41. DSIF station locations

Station	Location	Geodetic latitude, deg	Astronomic longitude, deg
12	Goldstone, California	35.4 N	116.8 W
41	Woomera, Australia	31.4 S	136.9 E
51	Johannesburg, South Africa	25.9 S	27.7 E
59	Johannesburg, South Africa	25.9 S	27.7 E

During *Ranger VII*, the DSIF stations provided both angular and doppler data throughout the mission. Both data types were used during the early part of the mission, and the angular data were very useful in obtaining the initial orbit estimates. For the postflight analysis, only two-way doppler data were used. Plots of the doppler residuals for both premaneuver and postmaneuver tracking may be seen in Figs. 8 through 24. Relatively large biases were seen in the angular data from Stations 41 and 51. This is mainly due to angular correction model errors which, in turn, were caused by recent extensive equipment changes and RF feed realignment at the angle tracking stations. New correction coefficients are being determined to remove these biases during future missions.

Table 42. Nominal[a] view periods vs actual tracking at DSIF stations

Date	DSIF Station	Nominal rise, GMT	Nominal set, GMT	Nominal view period	Acquisition by Station	Loss of signal by Station	Actual view period
July 28, 1964	51	17:21:17	17:32:00	$00^h10^m43^s$	17:21:38	17:32:55	$00^h11^m17^s$
	59	17:21:17	17:32:00	$00^h10^m43^s$	17:20:50	17:37:53	$00^h17^m03^s$
	41	17:36:54	00:46:21[b]	$07^h09^m27^s$	17:35:24	01:17:00	$07^h41^m36^s$
	51	20:42:52	08:28:04[b]	$11^h45^m12^s$	20:45:50	08:54:29	$12^h08^m39^s$
July 29, 1964	12	07:11:54	18:36:01	$11^h24^m07^s$	06:44:10	18:45:35	$12^h01^m25^s$
	41	14:38:45	01:24:04[b]	$10^h45^m19^s$	14:13:55	01:49:00	$11^h35^m05^s$
	51	22:00:10	08:48:32[b]	$10^h48^m22^s$	22:02:45	09:12:03	$11^h09^m18^s$
July 30, 1964	12	07:20:28	18:59:03	$11^h38^m35^s$	06:55:30	18:59:49	$12^h04^m19^s$
	41	14:59:08	01:31:08[b]	$10^h32^m00^s$	14:36:03	01:59:00	$11^h22^m57^s$
	51	22:14:05	08:53:41[b]	$10^h39^m36^s$	22:13:17	09:14:37	$11^h01^m20^s$
July 31, 1964	12	07:22:02	13:25:50[c]	$06^h03^m48^s$	07:00:56	13:25:50	$06^h24^m54^s$

[a] Based on 5-deg elevation angle.
[b] Set occurs on day after rise.
[c] Time of lunar impact.

Table 43. Ground station tracking modes

This mode description is used to define the station configuration. The code is broken into two parts. The first defines the transmit/receive mode and the second the antenna feed configuration.

Transmit/receive		Antenna feed	
GM-0[a]	No receive (transmit only)	0	Not used
GM-1	One-way doppler (receive only)	1	Horn feed diplexer combination (85-ft D reflector)
GM-2	Two-way, one-station (transmit/receive)	2	Tracking feed diplexer combination (85-ft D reflector)
GM-3	Two-way, two-station noncoherent (receive only)	3	Acquisition antenna
GM-4	Two-way, two-station coherent (receive only with reference signal from transmit station)	4	Dipole (6-ft D reflector)
GM-5	Receive only (no doppler)	5	Horn feed, no diplexer (receive only) (85-ft D reflector)

[a]Telemetry will be available in all receive modes except GM-0.
Example: GM-2-1; transmitting to spacecraft and receiving two-way doppler; horn feed and diplexer.

B. Transponder Tracking

1. Premaneuver Phase

Initial acquisition of the spacecraft transponder was made by Station 59 at 17:20:50 GMT on July 28, 1964. Two-way lock was immediately established and the servo system was put in auto track at 17:21:00. Auto track was terminated at 17:21:39 and the receiver dropped lock at 17:23:12. From this time until the end of the pass at 17:37:53, the receiver was unable to maintain continuous lock, primarily due to high spacecraft angular rates and operational procedure difficulties. From this pass only five 5-sec count two-way doppler points were usable in the ODP. At 17:28:07 Station 51 switched on their transmitter, and two-way lock was established at 17:30:14. Station 51 also experienced difficulty in maintaining continuous receiver lock due to high angle rates, and the antenna reached its mechanical limit at 17:31:42. During this interval, no good two-way doppler samples were obtained.

At 17:38:48, Station 41 achieved two-way lock in GM-2-2. They did not get any good doppler samples until 17:54:00 because of an overloaded counter monitoring the doppler mixer output. This situation arose as a direct result of a changed configuration in the L-band receiver following L–S band conversion work and was easily corrected when discovered. Telemetry event blips B-2-1 through B-2-4 observed by Station 41 starting at 17:50:00 indicated that solar panel extension had occurred. At 17:53:00 a B-2-1 blip was observed which indicated the start of the Sun acquisition sequence. Earth acquisition event blip was noted by Stations 41 and 51. The first ground station command sequence was transmitted to the spacecraft by Station 41, commencing at 21:15:00. Two "clear" commands were sent followed by an antenna switchover command which switches the spacecraft from the low gain omniantenna to the high gain directional antenna. During the mutual view period of Stations 41 and 51, transfers of two-way lock were executed three times. The first transfer, from Station 41 to 51, occurred at 21:58:00. The second transfer, from Station 51 to 41, occurred at 23:10:00. The third and last transfer of this pass, from Station 41 to 51, occurred at 24:00:00. Tracking continued without incident until the maneuver phase began on July 29.

2. Maneuver Phase

At 08:50:00 July 29, Station 12 started transmitting the midcourse maneuver command sequence. At 09:40:00 Station 12 transmitted the antenna changeover command which switched the spacecraft back to the low gain omniantenna, and at 10:00:00 the maneuver execute command was transmitted. At 10:27:09, after the programmed delay, an event blip was observed which indicated midcourse motor ignition. This was immediately followed by a decrease in received doppler frequency, as predicted. The decrease continued until motor cutoff, and then the observed doppler started to rise slightly, again as predicted. A plot showing predicted doppler and observed doppler during the maneuver period may be seen in Fig. 57.

3. Postmaneuver Phase

Following the maneuver, the spacecraft reacquired the Sun at 10:36:00, and the Earth at 10:58:39. At 11:21:00 Station 12 started transmitting the command sequence to switch the spacecraft back to the high gain antenna. Transponder tracking then continued in a normal manner with a minimum amount of data being lost when transferring from one station to another. At 11:15:30 on July 31, Station 12 began transmitting a terminal maneuver command sequence. While an orientation maneuver was not required, a terminal maneuver sequence was commanded to set an additional backup timer for the TV system. The terminal maneuver was then inhibited by

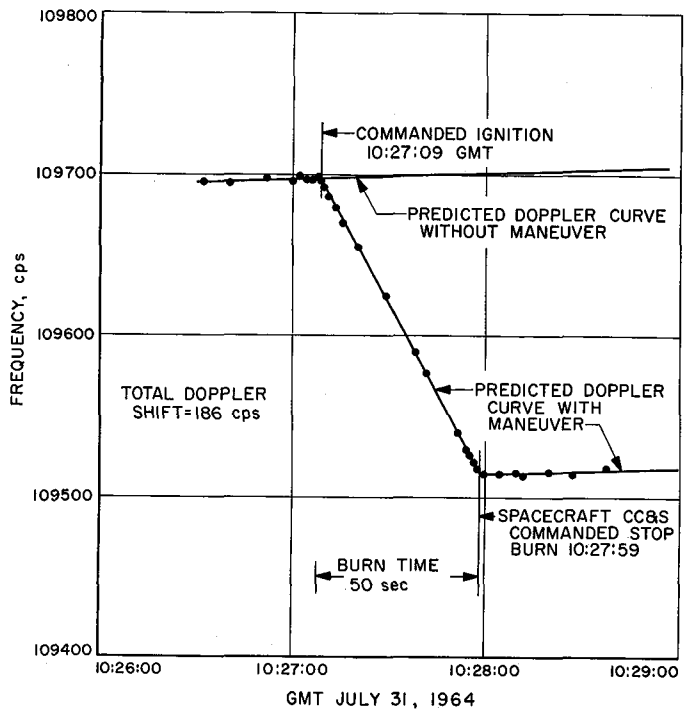


Fig. 57. Doppler during midcourse maneuver

an override command transmitted at 11:55:00. The terminal maneuver execute command was transmitted at 12:25:08. Subsequent event blips indicated that the spacecraft responded properly. At 13:08:40 Channel F video appeared, and at 13:12:07 Channel P video went to full power. From 13:12:08 until impact, Station 12 was receiving excellent photographs of the lunar surface. A summary of all commands transmitted to the spacecraft by the DSIF is given in Table 44.[15]

C. *Determination of Impact Time*

The primary method of determining observed impact time is by measuring the time at which the spacecraft signal is lost. Various functions related to the spacecraft signal are continuously recorded by the stations during their respective tracking periods. Two recording methods are used: one is magnetic tape, and the other is direct-write oscillograph.

Stations 11[16] and 12 were tracking the spacecraft on July 31 when an abrupt loss of signal occurred at approximately 13:25:50. Figure 58 shows the *unfiltered* received signal strength recorded at Station 12 at lunar encounter. High speed recording rate (approximately 60 in./sec) was not used until shortly before predicted impact. This recording was referenced by a 100 pps timing reference and the NASA 28-bit time code which is synchronized to WWV. At the time noted by the arrow in Fig. 58 (13:25:50.029), the transponder signal was lost. Figure 59 is a playback of the receiver functions recorded on magnetic tape at Station 12 starting just prior to impact. The drastic changes seen in the telemetry channels (the traces labeled Channel 2 and Channel 3) provide further confidence that impact occurred at the time noted by the abrupt change in received signal strength.

Table 44. Ground commands from DSIF to *Ranger VII*

Command[a]	Initiated (date/GMT)	Verified, GMT	DSIF Station	T/M event blips recorded at Station
RTC-0	28/21:15:00	21:15:38	41	
RTC-0	28/21:16:00	21:16:38	41	
RTC-3	28/21:19:00	21:19:38	41	B-20
RTC-0	29/08:50:00	08:50:39	12	
RTC-0	29/08:52:00	08:52:39	12	
SC-1	29/08:54:00	08:54:40	12	B-20
SC-2	29/08:56:00	08:56:41	12	B-20
SC-3	29/08:58:00	08:58:41	12	B-20
RTC-0	29/09:36:00	09:36:38	12	
RTC-0	29/09:38:00	09:38:39	12	
RTC-3	29/09:40:00	09:40:39	12	B-20
RTC-4	29/10:00:00	10:00:38	12	B-20
RTC-0	29/11:21:00	11:21:38	12	
RTC-0	29/11:23:00	11:23:39	12	
RTC-3	29/11:25:00	11:25:39	12	B-20
RTC-0	31/11:15:30	11:16:08	12	
RTC-0	31/11:17:30	11:18:09	12	
SC-4	31/11:19:30	11:20:10	12	B-20
SC-5	31/11:21:30	11:22:10	12	B-20
SC-6	31/11:23:30	11:24:10	12	B-20
RTC-0	31/11:51:00	11:51:38	12	
RTC-0	31/11:53:00	11:53:39	12	
RTC-8	31/11:55:00	11:55:38	12	B-20
RTC-6	31/12:25:08	12:25:47	12	B-20

[a]Real-Time Commands:
RTC-0 = clear command
RTC-3 = antenna switchover
RTC-4 = begin midcourse maneuver
RTC-6 = initiate terminal maneuver
RTC-8 = maneuver override

Stored Commands:
SC-1 = midcourse maneuver roll duration
SC-2 = midcourse maneuver pitch duration
SC-3 = midcourse maneuver velocity increment
SC-4 = terminal maneuver first pitch duration
SC-5 = terminal maneuver yaw duration
SC-6 = terminal maneuver second pitch duration

[15]Jet Propulsion Laboratory, *Tracking Operations Memorandum, Ranger VII*, September 21, 1964 (internal communication).

[16]Station 11 was committed to provide TV backup support only. They tracked the spacecraft only during the last Goldstone view period, but did not obtain tracking data.

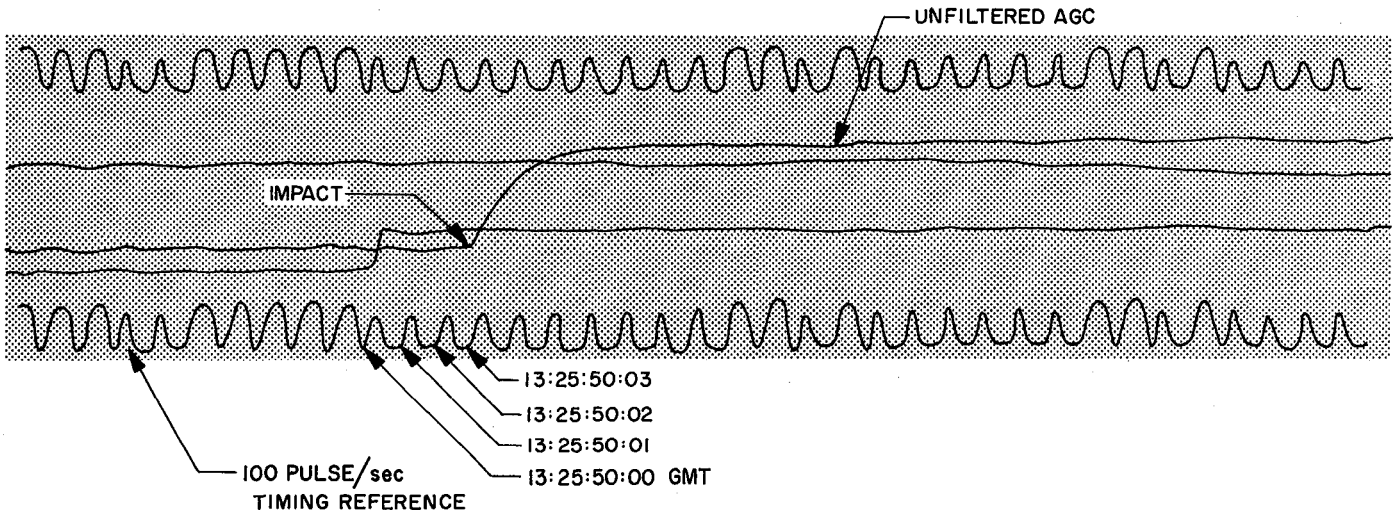


Fig. 58. Station 12 impact recording

Figure 60 is a playback of the magnetic tape recorded at Station 11. In this Figure, no abrupt change in the received signal strength can be seen at the impact time indicated by the drastic change in the telemetry channel traces. This is due to the fact that the receiver automatic gain control (AGC) time constant was set at 300 sec. The best estimate of impact time observed at Station 11 is 13:25:50.095. It will be noted that there is a 66-msec difference between the impact times recorded at the two Stations. After postflight analysis of station operations at Stations 11 and 12 in regard to this discrepancy, it was concluded that: (1) Station 11 impact time is incorrect because of a time synchronization problem at Station 11, and (2) the impact time recorded at Station 12 is correct. This large discrepancy should not be considered a measure of the system accuracy since in *Ranger VI*, when Stations 11 and 12 were committed for full mission support, the impact times recorded at the two Stations agreed to within 1 msec.

The conclusion is that, neglecting signal transit time, *Ranger VII* impacted the Moon at 13:25:50.029 +0.02 or −0.03 sec.

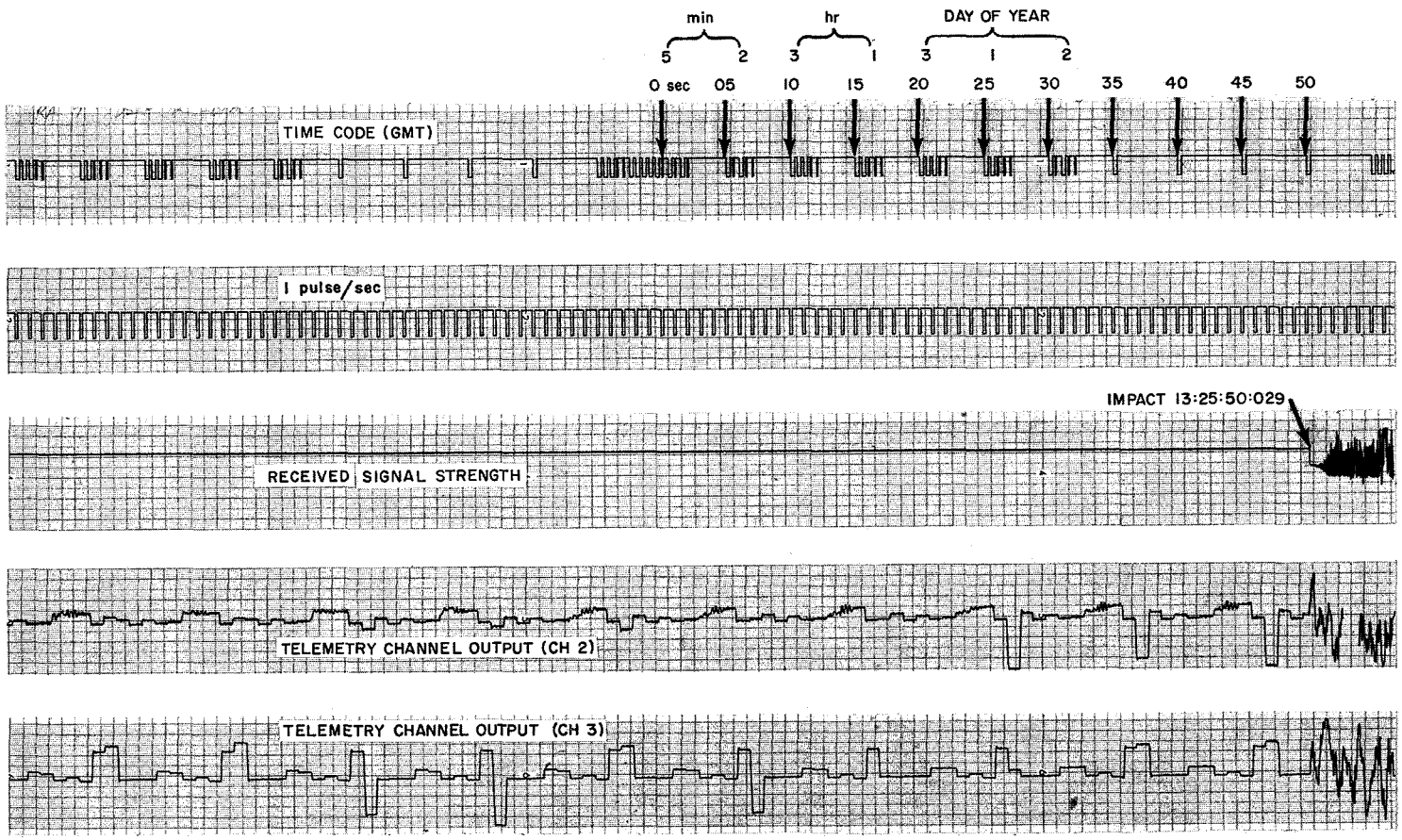


Fig. 59. Station 12 analog of selected receiver functions at lunar impact

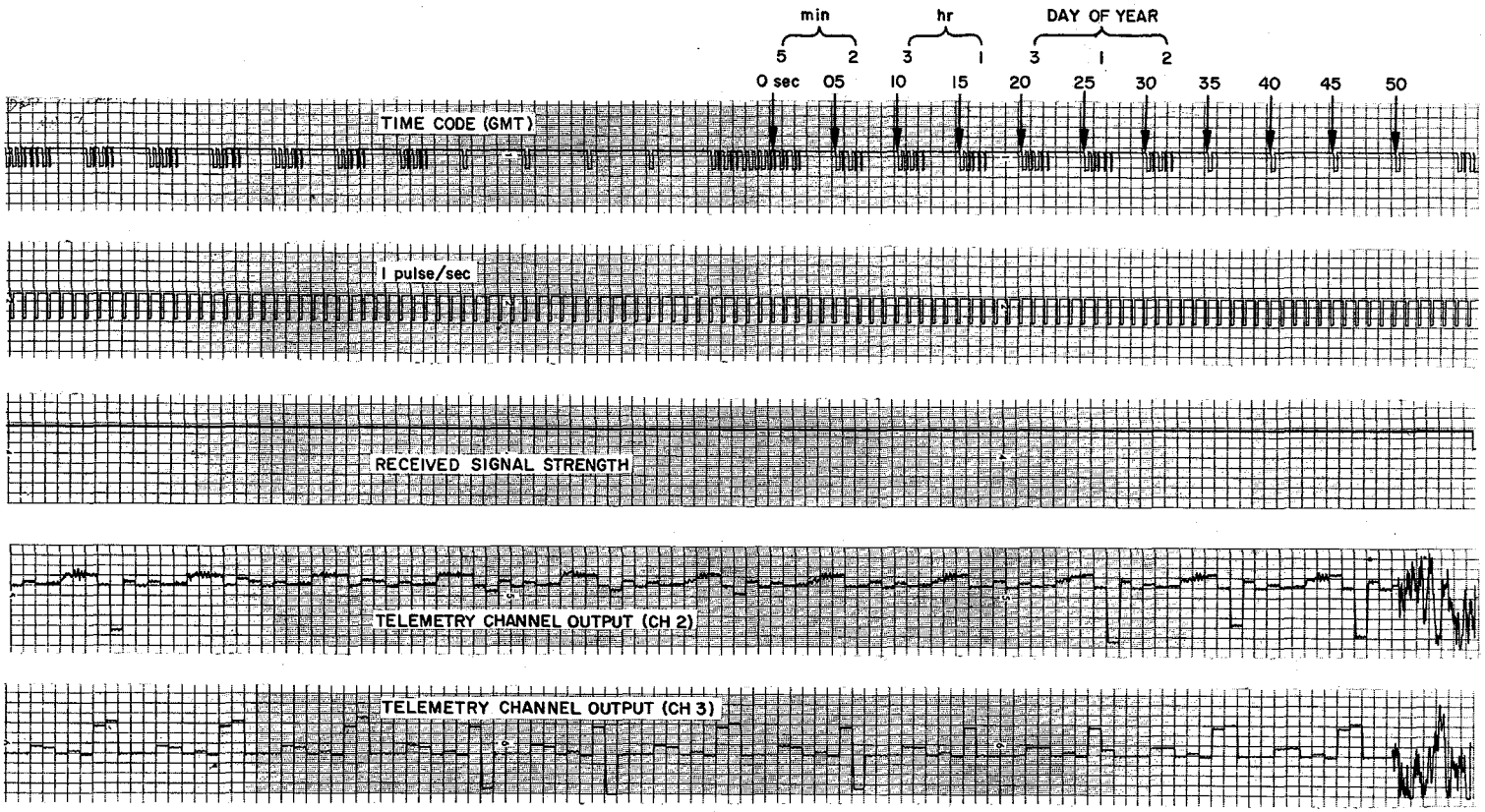


Fig. 60. Station 11 analog of selected receiver functions at lunar impact

APPENDIX A

Definition of the miss parameter B

The miss parameter **B** is used at JPL to measure miss distances for lunar and interplanetary trajectories and is described by W. Kizner in Ref. 6. **B** has the desirable feature of being very nearly a linear function of changes in injection conditions.

The osculating conic at closest approach to the target body is used in defining **B**. **B** is the vector from the target's center of mass perpendicular to the incoming asymptote. Let $\mathbf{S}_I$ be a unit vector in the direction of the incoming asymptote. The orientation of **B** in the plane normal to $\mathbf{S}_I$ is described in terms of two unit vectors **R** and **T**, normal to $\mathbf{S}_I$. **T** is taken parallel to a fixed *reference plane* and **R** completes a right-handed orthogonal system. Figure A-1 illustrates the situation.

The *Ranger VII* work has used the orbital plane of the Moon as the reference plane. If **W** is a unit vector normal to the orbital plane (**W** in direction of $\mathbf{R}_M \times \mathbf{V}_M$, where $\mathbf{R}_M$ is radius vector to Moon from Earth, and $\mathbf{V}_M$ is the space-fixed velocity of the Moon relative to the Earth's center), then $\mathbf{T} = \mathbf{S}_I \times \mathbf{W}$ defines our coordinate system.

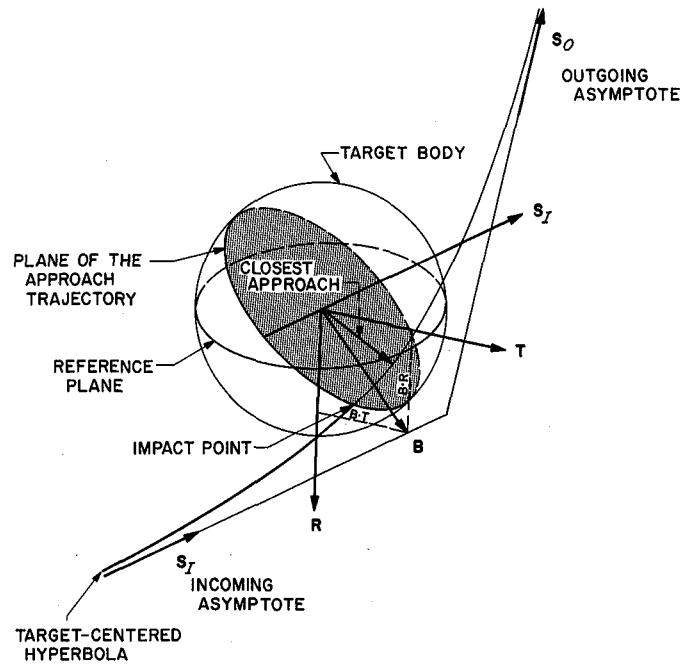


Fig. A-1. Definition of B·T, B·R system

APPENDIX B

Ranger VII space trajectory for premaneuver orbit

SPACE TRAJECTORY
RA-7 PREMIDCOURSE CRBIT.

GME	.39860145 06	J	.16234500-02	H	-.57499999-05	D	.78749999-05	RE	.63781650 04	REM	.63783100 04
G	.66709998-19	A	.88782497 29	B	.888C0499 29	C	.88837498 29	OME	.41780741-02	AU	.14959900 09
GMM	.49026957 04	GMS	.13271544 12	GMV	.32476950 06	GMA	.42977799 05	GMC	.37918700 08	GMJ	.12671060 09
EGM	.39860320 06	MGM	.49027779 04	JA	.292C0000-02	HA	.00000000 00	DA	.00000000 00	RA	.34170000 04
ARA	.35670000 01	GB	.38294392 00	MAS	.37410000 03	GB1	.00000000 00	GB2	.00000000 00	SC	.10200000 09

INJECTION CONDITIONS MOON 2356664502572020000000000 J.D.= 2438605.22217592 JULY 28,1964 17 19 56.000

GEOCENTRIC XO-.48336122 04 YO-.42062479 04 ZO-.14413998 04 DXO .70601073 01 DYO-.68712135 01 DZO-.47797462 01
CARTESIAN GMC .00000000 00 SGC .0C000000 00 TO .62396000 05 GHA .20638174 03 GHO .30568664 03

0 DAYS 0 HRS. 0 MIN. 0.000 SEC. 2356664502572020000000000 J.D.= 2438605.22217592 JULY 28,1964 17 19 56.000
TFL 0 DAYS 0 HRS. 29 MIN. 48.127 SEC.

GEOCENTRIC — EQUATORIAL COORDINATES

X	-.48336120 04	Y	-.42062476 04	Z	-.14413997 04	DX	.70601070 01	DY	-.68712132 01	DZ	-.47797460 01
R	.65676446 04	DEC	-.12677894 02	RA	.22103005 03	V	.10950098 02	PTH	.13272056 01	AZ	.11625194 03
R	.65676447 04	LAT	-.12677893 02	LON	.14648313 02	VE	.10533192 02	PTE	.13797469 01	AZE	.11737653 03
XS	-.88492690 08	YS	.11325740 09	ZS	.49113300 08	DXS	-.23722515 02	DYS	-.15814255 02	DZS	-.68579680 01
XM	.38246584 06	YM	-.30198953 05	ZM	-.50845670 05	DXM	.82773604-01	DYM	.93298925 00	DZM	.39361317 00
XT	.38246584 06	YT	-.30198953 05	ZT	-.50845670 05	DXT	.82773604-01	DYT	.93298925 00	DZT	.39361317 00
RS	.15188914 09	VS	.29323712 02	RM	.38701081 06	VM	.10159979 01	RT	.38701081 06	VT	.10159979 01
GED	-.12761470 02	ALT	.19047821 03	LOS	.28162025 03	RAS	.12800198 03	RAM	.35548537 03	LOM	.14910364 03
DUT	.35000000 02	DT	.15000000 02	DR	.25362684 00	SHA	.65203969 04	DES	.18865618 02	DEM	-.75493738 01

GEOCENTRIC CONIC

EPOCH OF PERICENTER PASSAGE 2356664502472027604266 60 J.D.= 2438605.22185045 JULY 28,1964 17 19 27.879

SMA	.26955704 06	ECC	.97564865 00	B	.59124444 05	SLR	.12968310 05	APO	.53254998 06	RCA	.65640771 04
VH	.13500527 00	C3	-.14787277 01	C1	.7189706C 05	TFP	.28120745 02	TF	-.78113180-02	PER	.23213209 05
TA	.26875478 01	MTA	.00000000 00	EA	.29842760 00	MA	.72684679-02	C3J	-.18712444 01	TFI	.00000000 00

ALL VECTORS REFERENCED TO EARTH EQUATOR PLANE

X	-.48336120 04	Y	-.42062476 04	Z	-.14413997 04	DX	.70601070 01	DY	-.68712132 01	DZ	-.47797460 01
INC	.28955996 02	LAN	.17040849 02	APF	.20426939 03	MX	.66197710 00	MY	-.61283270 00	MZ	-.43153497 00
WX	.14187827 00	WY	-.46288226 00	WZ	.87499177 00	PX	-.76620357 00	PY	-.61101017 00	PZ	-.19899402 00
QX	.62673967 00	QY	-.64218889 00	QZ	-.44135110 00	RX	.15558145 00	RY	.12406866 00	RZ	-.98000067 00
BX	-.62673967 00	BY	.64218890 00	BZ	.44135111 00	TX	-.62347934 00	TY	.78183983 00	TZ	.00000000 00
DAP	-.11478139 02	RAP	.21857066 03								
BTQ	.52789146 05	BRQ	-.26627162 05	B	.59124444 05	THA	.33323335 03				

HELIOCENTRIC — EQUATORIAL COORDINATES

X	.88487856 08	Y	-.11326160 09	Z	-.49114741 08	DX	.30782622 02	DY	.89430414 01	DZ	.20782219 01
R	.15188993 09	LAT	-.18866090 02	LON	.30799943 03	V	.32122684 02	PTH	.19253930 02	AZ	.78943384 02
XE	.88492690 08	YE	-.11325740 09	ZE	-.49113300 08	DXE	.23722515 02	DYE	.15814255 02	DZE	.68579680 01
XT	.88875155 08	YT	-.11328760 09	ZT	-.49164145 08	DXT	.23805288 02	DYT	.16747244 02	DZT	.72515811 01
LTE	-.18865618 02	LOE	.30800198 03	LTT	-.18852131 02	LOT	.30811451 03	RST	.15215119 09	VST	.29995789 02
EPS	.83120780 02	ESP	.27453512-18	SEP	.96876758 02	EPM	.48837777 02	EMP	.73198500 00	MEP	.13043019 03
MPS	.13183428 03	MSP	.10992114 00	SMP	.48055927 02	SEM	.13256592 03	EMS	.47326738 02	ESM	.10698938 00
RPM	.39130200 06	SPN	.69231548 01								
GCE	.27829543 03	GCT	.28210141 03	SIP	.13158023 03	CPT	.90011781 02	SIN	.89757735 02	D1	.13301877 00
REP	.65676446 04	VEP	.10950098 02	CPE	.80398673 02	CPS	.76802219 02	D2	.89203712-01	D3	.53001657-03

0 DAYS 0 HRS. 0 MIN. 5.000 SEC. 2356664502602022000000000 J.D.= 2438605.22223379 JULY 28,1964 17 20 01.000
TFL 0 DAYS 0 HRS. 29 MIN. 53.127 SEC.

GEOCENTRIC — EQUATORIAL COORDINATES

X	-.47982264 04	Y	-.42405294 04	Z	-.14652728 04	DX	.70940173 01	DY	-.68414752 01	DZ	-.47694813 01
R	.65690250 04	DEC	-.12888701 02	RA	.22146929 03	V	.10948918 02	PTH	.15626542 01	AZ	.11615460 03
R	.65690250 04	LAT	-.12888701 02	LON	.15066658 02	VE	.10531952 02	PTE	.16245366 01	AZE	.11727488 03
XS	-.88492808 08	YS	.11325732 09	ZS	.49113265 08	DXS	-.23722498 02	DYS	-.15814276 02	DZS	-.68579772 01
XM	.38246625 06	YM	-.30194288 05	ZM	-.50843702 05	DXM	.82760305-01	DYM	.93299019 00	DZM	.39361490 00
XT	.38246625 06	YT	-.30194288 05	ZT	-.50843702 05	DXT	.82760305-01	DYT	.93299019 00	DZT	.39361490 00
RS	.15188914 09	VS	.29323712 02	RM	.38701060 06	VM	.10159983 01	RT	.38701060 06	VT	.10159983 01
GED	-.12973572 02	ALT	.19189282 03	LOS	.28159941 03	RAS	.12800204 03	RAM	.35548607 03	LOM	.14908344 03
DUT	.35000000 02	DT	.50000000 01	DR	.29857805 00	SHA	.65150630 04	DES	.18865604 02	DEM	-.75490844 01

GEOCENTRIC CONIC

EPOCH OF PERICENTER PASSAGE 2356664502472027613024 20 J.D.= 2438605.22185053 JULY 28,1964 17 19 27.886

SMA	.26949663 06	ECC	.97564318 00	B	.59117748 05	SLR	.12968278 05	APO	.53242917 06	RCA	.65640789 04
VH	.13503574 00	C3	-.14790591 01	C1	.71896970 05	TFP	.33114219 02	TF	-.78095051-02	PER	.23205406 05
TA	.31643331 01	MTA	.00000000 00	EA	.35143499 00	MA	.85620267-02	C3J	-.18715458 01	TFI	.13888889-02

ALL VECTORS REFERENCED TO EARTH EQUATOR PLANE

X	-.47982264 04	Y	-.42405294 04	Z	-.14652728 04	DX	.70940173 01	DY	-.68414752 01	DZ	-.47694813 01
INC	.28955870 02	LAN	.17040714 02	APF	.20427C14 03	MX	.66808686 00	MY	-.60747611 00	MZ	-.42968909 00
WX	.14187660 00	WY	-.46288C72 00	WZ	.87499284 00	PX	-.76619674 00	PY	-.61101718 00	PZ	-.19899899 00
QX	.62674844 00	QY	-.64218335 00	QZ	-.44134673 00	RX	.15558410 00	RY	.12407330 00	RZ	-.97999970 00
BX	-.62674844 00	BY	.64218335 00	BZ	.44134673 00	TX	-.62348710 00	TY	.78183364 00	TZ	.00000000 00
DAP	-.11478429 02	RAP	.21857123 03								
BTQ	.52783288 05	BRQ	-.26623911 05	B	.59117748 05	THA	.33323360 03				

HELIOCENTRIC — EQUATORIAL COORDINATES

X	.88488009 08	Y	-.11326156 09	Z	-.49114731 08	DX	.30816516 02	DY	.89728008 01	DZ	.20884959 01
R	.15188998 09	LAT	-.18866079 02	LON	.30799949 03	V	.32164119 02	PTH	.19217327 02	AZ	.78943203 02
XE	.88492808 08	YE	-.11325732 09	ZE	-.49113265 08	DXE	.23722498 02	DYE	.15814276 02	DZE	.68579772 01
XT	.88875274 08	YT	-.11328751 09	ZT	-.49164109 08	DXT	.23805258 02	DYT	.16747266 02	DZT	.72515921 01
LTE	-.18865604 02	LOE	.30800204 03	LTT	-.18852117 02	LOT	.30811457 03	RST	.15215119 09	VST	.29995780 02
EPS	.82648540 02	ESP	.27453512-18	SEP	.97349001 02	EPM	.49307519 02	EMP	.73734523 00	MEP	.12995507 03
MPS	.13182829 03	MSP	.10992114 00	SMP	.4806192C 02	SEM	.13256523 03	EMS	.47327432 02	ESM	.10676052 00
RPM	.39126154 06	SPN	.64998379 01								
GCE	.27822519 03	GCT	.28209986 03	SIP	.13157421 03	CPT	.90011039 02	SIN	.89756966 02	D1	.13303253 00
REP	.65690250 04	VEP	.10948918 02	CPE	.80365963 02	CPS	.76802228 02	D2	.89202610-01	D3	.53001469-03

0 DAYS 0 HRS. 40 MIN. 4.000 SEC. 2356664514102020000000000 J.D.= 2438605.25000000 JULY 28,1964 18 00 00.000
TFL 0 DAYS 1 HRS. 9 MIN. 52.127 SEC.

GEOCENTRIC — EQUATORIAL COORDINATES

X	.14133998 05	Y	-.79897407 04	Z	-.65075322 04	DX	.65614168 01	DY	.74185279 00	DZ	-.66640706 00
R	.17491536 05	DEC	-.21841418 02	RA	.33052116 03	V	.66367638 01	PTH	.51736660 02	AZ	.70518666 02
R	.17491536 05	LAT	-.21841418 02	LON	.11409534 03	VE	.60227493 01	PTE	.59907895 02	AZE	.63005507 02
XS	-.88549711 08	YS	.11321937 09	ZS	.49096807 08	DXS	-.23714533 02	DYS	-.15824559 02	DZS	-.68624289 01
XM	.38265713 06	YM	-.27955511 05	ZM	-.49898428 05	DXM	.76375878-01	DYM	.93342563 00	DZM	.39443802 00
XT	.38265713 06	YT	-.27955511 05	ZT	-.49898428 05	DXT	.76375878-01	DYT	.93342563 00	DZT	.39443802 00
RS	.15188869 09	VS	.29323858 02	RM	.38690805 06	VM	.10162175 01	RT	.38690805 06	VT	.10162175 01
GED	-.21976129 02	ALT	.11116318 05	LOS	.27160339 03	RAS	.12802923 03	RAM	.35582160 03	LOM	.13939578 03
DUT	.35000000 02	DT	.12000000 03	DR	.52110063 01	SHA	.63476066 04	DES	.18859101 02	DEM	-.74099125 01

HELIOCENTRIC — EQUATORIAL COORDINATES

X	.88563844 08	Y	-.11322736 09	Z	-.49103315 08	DX	.30275949 02	DY	.16566412 02	DZ	.61960218 01
R	.15190498 09	LAT	-.18859597 02	LON	.30803170 03	V	.35063796 02	PTH	.54008952 01	AZ	.77299199 02
XE	.88549711 08	YE	-.11321937 09	ZE	-.49096807 08	DXE	.23714533 02	DYE	.15824559 02	DZE	.68624289 01
XT	.88932368 08	YT	-.11324732 09	ZT	-.49146705 08	DXT	.23790908 02	DYT	.16757985 02	DZT	.72568669 01
LTE	-.18859101 02	LOE	.30802923 03	LTI	-.18845472 02	LOT	.30814231 03	RST	.15214901 09	VST	.29991657 02
EPS	.21275752 02	ESP	.27453512-18	SEP	.15872185 03	EPM	.15038071 03	EMP	.12802933 01	MEP	.28338988 02
MPS	.13099385 03	MSP	.10560881 00	SMP	.48900525 02	SEM	.13223181 03	EMS	.47660310 02	ESM	.10767302 00
RPM	.37160557 06	SPN	-.10927629 00								
GCE	.12130756 03	GCT	.28173927 03	SIP	.13072634 03	CPT	.90012081 02	SIN	.89744569 02	D1	.14006939 00
REP	.17491536 05	VEP	.66367638 01	CPE	.88331660 02	CPS	.76806234 02	D2	.92401281-01	D3	.57049358-03

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TFL 0 DAYS 2 HRS. 9 MIN. 52.127 SEC.

GEOCENTRIC — EQUATORIAL COORDINATES

X	.33222362 05	Y	-.36139479 04	Z	-.72726185 04	DX	.44486546 01	DY	.14096569 01	DZ	.27990459-01
R	.34200539 05	DEC	-.12277478 02	RA	.35379174 03	V	.46667380 01	PTH	.63228434 02	AZ	.63577902 02
R	.34200539 05	LAT	-.12277478 02	LON	.12232485 03	VE	.43060543 01	PTE	.75373607 02	AZE	.32934351 03
XS	-.88635067 08	YS	.11316237 09	ZS	.49072091 08	DXS	-.23702569 02	DYS	-.15839986 02	DZS	-.68691069 01
XM	.38291482 06	YM	-.24594091 05	ZM	-.48476264 05	DXM	.66779521-01	DYM	.93400983 00	DZM	.39564490 00
XT	.38291482 06	YT	-.24594091 05	ZT	-.48476264 05	DXT	.66779521-01	DYT	.93400983 00	DZT	.39564490 00
RS	.15188801 09	VS	.29324078 02	RM	.38675389 06	VM	.10165475 01	RT	.38675389 06	VT	.10165475 01
GED	-.12358584 02	ALT	.27823309 05	LOS	.25660313 03	RAS	.12807002 03	RAM	.35632502 03	LOM	.12485812 03
DUT	.35000000 02	DT	.24000000 03	DR	.41665079 01	SHA	.23935082 05	DES	.18849337 02	DEM	-.72004715 01

HELIOCENTRIC — EQUATORIAL COORDINATES

X	.88668289 08	Y	-.11316598 09	Z	-.49079363 08	DX	.28151223 02	DY	.17249643 02	DZ	.68970973 01
R	.15191244 09	LAT	-.18849089 02	LON	.30807956 03	V	.33728496 02	PTH	.22990638 01	AZ	.76705508 02
XE	.88635067 08	YE	-.11316237 09	ZE	-.49072091 08	DXE	.23702569 02	DYE	.15839986 02	DZE	.68691069 01
XT	.89017981 08	YT	-.11318696 09	ZT	-.49120567 08	DXT	.23769348 02	DYT	.16773996 02	DZT	.72647518 01
LTE	-.18849337 02	LOE	.30807003 03	LTI	-.18835495 02	LOT	.30818393 03	RST	.15214572 09	VST	.29985420 02
EPS	.44405553 02	ESP	.98911702-02	SEP	.13558542 03	EPM	.17379502 03	EMP	.54751208 00	MEP	.56573230 01
MPS	.13135258 03	MSP	.99650790-01	SMP	.48547699 02	SEM	.13173113 03	EMS	.48160176 02	ESM	.10857785 00
RPM	.35273604 06	SPN	.33657638 02								
GCE	.10785988 03	GCT	.28161274 03	SIP	.13107076 03	CPT	.90207570 02	SIN	.89925747 02	D1	.14756255 00
REP	.34200539 05	VEP	.46667380 01	CPE	.92633329 02	CPS	.76811382 02	D2	.98046137-01	D3	.64107799-03

0 DAYS 2 HRS. 40 MIN. 4.000 SEC. 2356664550202020000000000 J.D.= 2438605.33333333 JULY 28,1964 20 00 00.000
TFL 0 DAYS 3 HRS. 9 MIN. 52.127 SEC.

GEOCENTRIC — EQUATORIAL COORDINATES

X	.47538591 05	Y	.15599436 04	Z	-.68452390 04	DX	.35982859 01	DY	.14413985 01	DZ	.18201312 00
R	.48054222 05	DEC	-.81895410 01	RA	.18794456 01	V	.38805179 01	PTH	.67323476 02	AZ	.62137302 02
R	.48054222 05	LAT	-.81895410 01	LON	.11537149 03	VE	.42324548 01	PTE	.57776242 02	AZE	.28804743 03
XS	-.88720372 08	YS	.11310532 09	ZS	.49047352 08	DXS	-.23690595 02	DYS	-.15855405 02	DZS	-.68757819 01
XM	.38313793 06	YM	-.21230733 05	ZM	-.47049823 05	DXM	.57165073-01	DYM	.93451068 00	DZM	.39681765 00
XT	.38313793 06	YT	-.21230733 05	ZT	-.47049823 05	DXT	.57165073-01	DYT	.93451068 00	DZT	.39681765 00
RS	.15188732 09	VS	.29324299 02	RM	.38659940 06	VM	.10168787 01	RT	.38659940 06	VT	.10168787 01
GED	-.82445862 01	ALT	.41676454 05	LOS	.24160285 03	RAS	.12811081 03	RAM	.35682832 03	LOM	.11032037 03
DUT	.35000000 02	DT	.48000000 03	DR	.35805389 01	SHA	.38454989 05	DES	.18839563 02	DEM	-.69903263 01

HELIOCENTRIC — EQUATORIAL COORDINATES

X	.88767910 08	Y	-.11310376 09	Z	-.49054197 08	DX	.27288881 02	DY	.17296803 02	DZ	.70577950 01
R	.15191615 09	LAT	-.18838583 02	LON	.30812610 03	V	.33070755 02	PTH	.13667131 01	AZ	.76485091 02
XE	.88720372 08	YE	-.11310532 09	ZE	-.49047352 08	DXE	.23690595 02	DYE	.15855405 02	DZE	.68757819 01
XT	.89103509 08	YT	-.11312655 09	ZT	-.49094402 08	DXT	.23747760 02	DYT	.16789915 02	DZT	.72725996 01
LTE	-.18839563 02	LOE	.30811081 03	LTI	-.18825510 02	LOT	.30822554 03	RST	.15214240 09	VST	.29979127 02
EPS	.53138674 02	ESP	.98911702-02	SEP	.12684682 03	EPM	.17412231 03	EMP	.72934040 00	MEP	.51483493 01
MPS	.13185658 03	MSP	.94872782-01	SMP	.48048394 02	SEM	.13123005 03	EMS	.48660454 02	ESM	.10925156 00
RPM	.33876649 06	SPN	.45511581 02								
GCE	.10557584 03	GCT	.28156552 03	SIP	.13156314 03	CPT	.90389438 02	SIN	.90095994 02	D1	.15364767 00
REP	.48054222 05	VEP	.38805179 01	CPE	.94149206 02	CPS	.76816137 02	D2	.10310525 00	D3	.70734355-03

0 DAYS 3 HRS. 40 MIN. 4.000 SEC. 2356664566242020000000000 J.D.= 2438605.37500000 JULY 28,1964 21 00 00.000
TFL 0 DAYS 4 HRS. 9 MIN. 52.127 SEC.

GEOCENTRIC — EQUATORIAL COORDINATES

X	.59546763 05	Y	.66919147 04	Z	-.60675792 04	DX	.31096832 01	DY	.14059146 01	DZ	.24208696 00
R	.60228018 05	DEC	-.57819839 01	RA	.64120432 01	V	.34213055 01	PTH	.69580915 02	AZ	.61585277 02
R	.60228018 05	LAT	-.57819839 01	LON	.10486302 03	VE	.46501270 01	PTE	.43591700 02	AZE	.27970913 03
XS	-.88805640 08	YS	.11304821 09	ZS	.49022587 08	DXS	-.23678608 02	DYS	-.15870818 02	DZS	-.68824544 01
XM	.38332639 06	YM	-.17865706 05	ZM	-.45619216 05	DXM	.47533251-01	DYM	.93492800 00	DZM	.39795607 00
XT	.38332639 06	YT	-.17865706 05	ZT	-.45619216 05	DXT	.47533251-01	DYT	.93492800 00	DZT	.39795607 00
RS	.15188664 09	VS	.29324521 02	RM	.38644458 06	VM	.10172113 01	RT	.38644458 06	VT	.10172113 01
GED	-.58211172 01	ALT	.53850031 05	LOS	.22660257 03	RAS	.12815160 03	RAM	.35733154 03	LOM	.95782512 02
DUT	.35000000 02	DT	.48000000 03	DR	.32063307 01	SHA	.51152511 05	DES	.18829780 02	DEM	-.67794920 01

HELIOCENTRIC — EQUATORIAL COORDINATES

X	.88865186 08	Y	-.11304152 09	Z	-.49028654 08	DX	.26788291 02	DY	.17276733 02	DZ	.71245413 01
R	.15191845 09	LAT	-.18828109 02	LON	.30817190 03	V	.32662778 02	PTH	.90358792 00	AZ	.76357554 02
XE	.88805640 08	YE	-.11304821 09	ZE	-.49022587 08	DXE	.23678608 02	DYE	.15870818 02	DZE	.68824544 01
XT	.89188966 08	YT	-.11306607 09	ZT	-.49068205 08	DXT	.23726141 02	DYT	.16805746 02	DZT	.72804104 01
LTE	-.18829780 02	LOE	.30815160 03	LTI	-.18815516 02	LOT	.30826714 03	RST	.15213907 09	VST	.29972775 02
EPS	.58117861 02	ESP	.19782341-01	SEP	.12186284 03	EPM	.16925407 03	EMP	.16651865 01	MEP	.90807154 01
MPS	.13236748 03	MSP	.90923484-01	SMP	.47541504 02	SEM	.13072857 03	EMS	.49161142 02	ESM	.11058666 00
RPM	.32710955 06	SPN	.52038979 02								
GCE	.10450602 03	GCT	.28154460 03	SIP	.13206357 03	CPT	.90554344 02	SIN	.90250442 02	D1	.15912324 00
REP	.60228018 05	VEP	.34213055 01	CPE	.94971955 02	CPS	.76820711 02	D2	.10783757 00	D3	.77226583-03

0 DAYS 4 HRS. 40 MIN. 4.000 SEC. 2356664643020202000000000 J.D.= 2438605.41666666 JULY 28,1964 22 00 00.000
TFL 0 DAYS 5 HRS. 9 MIN. 52.127 SEC.

GEOCENTRIC — EQUATORIAL COORDINATES

X	.70115787 05	Y	.11671274 05	Z	-.51384184 04	DX	.27807035 01	DY	.13600434 01	DZ	.27090856 00
R	.71266019 05	DEC	-.41347250 01	RA	.94506440 01	V	.31073174 01	PTH	.71056639 02	AZ	.61322150 02
R	.71266018 05	LAT	-.41347250 01	LON	.92860554 02	VE	.52294714 01	PTE	.34195045 02	AZE	.27642565 03
XS	-.88890865 08	YS	.11299104 09	ZS	.48997797 08	DXS	-.23666610 02	DYS	-.15886225 02	DZS	-.68891238 01
XM	.38348015 06	YM	-.14499333 05	ZM	-.44184573 05	DXM	.37884935-01	DYM	.93526153 00	DZM	.39905997 00
XT	.38348015 06	YT	-.14499333 05	ZT	-.44184573 05	DXT	.37884935-01	DYT	.93526153 00	DZT	.39905997 00
RS	.15188596 09	VS	.29324744 02	RM	.38628943 06	VM	.10175452 01	RT	.38628943 06	VT	.10175452 01
GED	-.41628034 01	ALT	.64887925 05	LOS	.21160229 03	RAS	.12819238 03	RAM	.35783468 03	LOM	.81244590 02
DUT	.35000000 02	DT	.48000000 03	DR	.29390249 01	SHA	.62627076 05	DES	.18819988 02	DEM	-.65679850 01

HELIOCENTRIC — EQUATORIAL COORDINATES

X	.88960980 08	Y	-.11297937 09	Z	-.49002935 08	DX	.26447313 02	DY	.17246268 02	DZ	.71600323 01
R	.15191998 09	LAT	-.18817663 02	LON	.30821722 03	V	.32375302 02	PTH	.62258625 00	AZ	.76269077 02
XE	.88890865 08	YE	-.11299104 09	ZE	-.48997797 08	DXE	.23666610 02	DYE	.15886225 02	DZE	.68891238 01
XT	.89274345 08	YT	-.11300554 09	ZT	-.49041981 08	DXT	.23704495 02	DYT	.16821486 02	DZT	.72881837 01
LTE	-.18819988 02	LOE	.30819238 03	LTT	-.18805513 02	LOT	.30830872 03	RST	.15213572 09	VST	.29966366 02
EPS	.61471794 02	ESP	.22117329-01	SEP	.11850458 03	EPM	.16554256 03	EMP	.26399439 01	MEP	.11817482 02
MPS	.13286451 03	MSP	.87076018-01	SMP	.47048021 02	SEM	.13022668 03	EMS	.49662242 02	ESM	.11058666 00
RPM	.31687020 06	SPN	.56337199 02								
GCE	.10385194 03	GCT	.28153676 03	SIP	.13255078 03	CPT	.90705702 02	SIN	.90391980 02	D1	.16426531 00
REP	.71266019 05	VEP	.31073174 01	CPE	.95506234 02	CPS	.76825176 02	D2	.11237662 00	D3	.83732973-03

0 DAYS 5 HRS. 40 MIN. 4.000 SEC. 2356664622342020000000000 J.D.= 2438605.45833333 JULY 28,1964 23 00 00.000
TFL 0 DAYS 6 HRS. 9 MIN. 52.127 SEC.

GEOCENTRIC — EQUATORIAL COORDINATES

X	.79670782 05	Y	.16485287 05	Z	-.41330882 04	DX	.25386541 01	DY	.13148349 01	DZ	.28605484 00
R	.81463369 05	DEC	-.29081801 01	RA	.11690525 02	V	.28732181 01	PTH	.72113998 02	AZ	.61184029 02
R	.81463365 05	LAT	-.29081801 01	LON	.80059373 02	VE	.58548217 01	PTE	.27841421 02	AZE	.27471253 03
XS	-.88976042 08	YS	.11293382 09	ZS	.48972986 08	DXS	-.23654601 02	DYS	-.15901624 02	DZS	-.68957903 01
XM	.38359915 06	YM	-.11131917 05	ZM	-.42746023 05	DXM	.28220959-01	DYM	.93551101 00	DZM	.40012920 00
XT	.38359915 06	YT	-.11131917 05	ZT	-.42746023 05	DXT	.28220959-01	DYT	.93551101 00	DZT	.40012920 00
RS	.15188528 09	VS	.29324967 02	RM	.38613398 06	VM	.10178805 01	RT	.38613398 06	VT	.10178805 01
GED	-.29279643 01	ALT	.75085218 05	LOS	.19660201 03	RAS	.12823316 03	RAM	.35833776 03	LOM	.66706604 02
DUT	.35000000 02	DT	.48000000 03	DR	.27343540 01	SHA	.73201279 05	DES	.18810190 02	DEM	-.63558179 01

HELIOCENTRIC — EQUATORIAL COORDINATES

X	.89055712 08	Y	-.11291734 09	Z	-.48977119 08	DX	.26193254 02	DY	.17216459 02	DZ	.71818451 01
R	.15192104 09	LAT	-.18807242 02	LON	.30826216 03	V	.32156989 02	PTH	.43249355 00	AZ	.76201302 02
XE	.88976042 08	YE	-.11293382 09	ZE	-.48972986 08	DXE	.23654601 02	DYE	.15901624 02	DZE	.68957903 01
XT	.89359641 08	YT	-.11294495 09	ZT	-.49015732 08	DXT	.23682821 02	DYT	.16837135 02	DZT	.72959195 01
LTE	-.18810190 02	LOE	.30823316 03	LTT	-.18795502 02	LOT	.30835029 03	RST	.15213234 09	VST	.29959899 02
EPS	.63944309 02	ESP	.25217635-01	SEP	.11602808 03	EPM	.16264583 03	EMP	.36078911 01	MEP	.13746265 02
MPS	.13334353 03	MSP	.83344489-01	SMP	.46572208 02	SEM	.12972439 03	EMS	.50163756 02	ESM	.11168705 00
RPM	.30761359 06	SPN	.59453864 02								
GCE	.10339768 03	GCT	.28153666 03	SIP	.13302037 03	CPT	.90846159 02	SIN	.90522998 02	D1	.16920848 00
REP	.81463369 05	VEP	.28732181 01	CPE	.95889083 02	CPS	.76829565 02	D2	.11679722 00	D3	.90339308-03

0 DAYS 6 HRS. 40 MIN. 4.000 SEC. 2356666464040202000000000 J.D.= 2438605.50000000 JULY 29,1964 00 00 00.000
TFL 0 DAYS 7 HRS. 9 MIN. 52.127 SEC.

GEOCENTRIC — EQUATORIAL COORDINATES

X	.88457831 05	Y	.21141938 05	Z	-.30870670 04	DX	.23501867 01	DY	.12727788 01	DZ	.29422427 00
R	.91001644 05	DEC	-.19440281 01	RA	.13441860 02	V	.26888494 01	PTH	.72916260 02	AZ	.61109238 02
R	.91001640 05	LAT	-.19440281 01	LON	.66769594 02	VE	.64839453 01	PTE	.23353045 02	AZE	.27367576 03
XS	-.89061177 08	YS	.11287655 09	ZS	.48948152 08	DXS	-.23642580 02	DYS	-.15917017 02	DZS	-.69024539 01
XM	.38368332 06	YM	-.77637567 04	ZM	-.41303686 05	DXM	.18542117-01	DYM	.93567621 00	DZM	.40116353 00
XT	.38368332 06	YT	-.77637567 04	ZT	-.41303686 05	DXT	.18542117-01	DYT	.93567621 00	DZT	.40116353 00
RS	.15188459 09	VS	.29325192 02	RM	.38597818 06	VM	.10182170 01	RT	.38597818 06	VT	.10182170 01
GED	-.19572659 01	ALT	.84623463 05	LOS	.18160166 03	RAS	.12827393 03	RAM	.35884079 03	LOM	.52168518 02
DUT	.35000000 02	DT	.95999999 03	DR	.25702078 01	SHA	.83072371 05	DES	.18800381 02	DEM	-.61430080 01

HELIOCENTRIC — EQUATORIAL COORDINATES

X	.89149634 08	Y	-.11285541 09	Z	-.48951239 08	DX	.25992766 02	DY	.17189795 02	DZ	.71966782 01
R	.15192177 09	LAT	-.18796838 02	LON	.30830681 03	V	.31982888 02	PTH	.29477559 00	AZ	.76146056 02
XE	.89061177 08	YE	-.11287655 09	ZE	-.48948152 08	DXE	.23642580 02	DYE	.15917017 02	DZE	.69024539 01
XT	.89444860 08	YT	-.11288431 09	ZT	-.48989455 08	DXT	.23661122 02	DYT	.16852693 02	DZT	.73036174 01
LTE	-.18800381 02	LOE	.30827393 03	LTT	-.18785483 02	LOT	.30839185 03	RST	.15212895 09	VST	.29953376 02
EPS	.65873232 02	ESP	.29673510-01	SEP	.11409544 03	EPM	.16028323 03	EMP	.45622200 01	MEP	.15154551 02
MPS	.13380434 03	MSP	.80660059-01	SMP	.46114365 02	SEM	.12922169 03	EMS	.50665688 02	ESM	.11190583 00
RPM	.29908885 06	SPN	.61854268 02								
GCE	.10305767 03	GCT	.28154164 03	SIP	.13347196 03	CPT	.90977596 02	SIN	.90645223 02	D1	.17403148 00
REP	.91001644 05	VEP	.26888494 01	CPE	.96181048 02	CPS	.76833903 02	D2	.12114677 00	D3	.97103892-03

0 DAYS 7 HRS. 40 MIN. 4.000 SEC. 2356664656442020000000000 J.D.= 2438605.54166666 JULY 29,1964 01 00 00.000
TFL 0 DAYS 8 HRS. 9 MIN. 52.127 SEC.

GEOCENTRIC — EQUATORIAL COORDINATES

X	.96634863 05	Y	.25653528 05	Z	-.20193274 04	DX	.21975617 01	DY	.12342340 01	DZ	.29846922 00
R	.10000239 06	DEC	-.11570391 01	RA	.14867312 02	V	.25380494 01	PTH	.73549204 02	AZ	.61069863 02
R	.10000239 06	LAT	-.11570391 01	LON	.53153981 02	VE	.71010397 01	PTE	.20046813 02	AZE	.27298770 03
XS	-.89146271 08	YS	.11281922 09	ZS	.48923289 08	DXS	-.23630547 02	DYS	-.15932404 02	DZS	-.69091148 01
XM	.38373263 06	YM	-.43951412 04	ZM	-.39857683 05	DXM	.88492171-02	DYM	.93575701 00	DZM	.40216284 00
XT	.38373263 06	YT	-.43951412 04	ZT	-.39857683 05	DXT	.88492171-02	DYT	.93575701 00	DZT	.40216284 00
RS	.15188391 09	VS	.29325417 02	RM	.38582208 06	VM	.10185551 01	RT	.38582208 06	VT	.10185551 01
GED	-.11649220 01	ALT	.93624190 05	LOS	.16660137 03	RAS	.12831470 03	RAM	.35934378 03	LOM	.37630451 02
DUT	.35000000 02	DT	.95999999 03	DR	.24341500 01	SHA	.92371781 05	DES	.18790561 02	DEM	-.59295698 01

HELIOCENTRIC — EQUATORIAL COORDINATES

X	.89242905 08	Y	-.11279356 09	Z	-.48925309 08	DX	.25828108 02	DY	.17166638 02	DZ	.72075840 01
R	.15192225 09	LAT	-.18786445 02	LON	.30835124 03	V	.31839188 02	PTH	.19018405 00	AZ	.76099076 02
XE	.89146271 08	YE	-.11281922 09	ZE	-.48923289 08	DXE	.23630547 02	DYE	.15932404 02	DZE	.69091148 01
XT	.89530003 08	YT	-.11282361 09	ZT	-.48963147 08	DXT	.23639396 02	DYT	.16868161 02	DZT	.73112776 01
LTE	-.18790561 02	LOE	.30831470 03	LTT	-.18775454 02	LOT	.30843339 03	RST	.15212554 09	VST	.29946797 02
EPS	.67437661 02	ESP	.32805301-01	SEP	.11252750 03	EPM	.15829056 03	EMP	.55017063 01	MEP	.16207723 02
MPS	.13424775 03	MSP	.78196572-01	SMP	.45673696 02	SEM	.12871858 03	EMS	.51168033 02	ESM	.11320963 00
RPM	.29113535 06	SPN	.63780942 02								
GCE	.10279032 03	GCT	.28155018 03	SIP	.13390630 03	CPT	.91101380 02	SIN	.90759926 02	D1	.17878600 00
REP	.10000239 06	VEP	.25380494 01	CPE	.96413475 02	CPS	.76838198 02	D2	.12545824 00	D3	.10407149-02

0 DAYS 8 HRS. 40 MIN. 4.000 SEC. 2356664674502020000000000 J.D.= 2438605.58333334 JULY 29,1964 02 00 00.000
TFL 0 DAYS 9 HRS. 9 MIN. 52.127 SEC.

GEOCENTRIC — EQUATORIAL COORDINATES

X	.10431062 06	Y	.30032377 05	Z	-.94089186 03	DX	.20703478 01	DY	.11989770 01	DZ	.30035464 00
R	.10855199 06	DEC	-.49662647 00	RA	.16061793 02	V	.24112442 01	PTH	.74062856 02	AZ	.61051660 02
R	.10855199 06	LAT	-.49662647 00	LON	.39307400 02	VE	.77004187 01	PTE	.17523435 02	AZE	.27250127 03
XS	-.89231324 08	YS	.11276183 09	ZS	.48898404 08	DXS	-.23618502 02	DYS	-.15947784 02	DZS	-.69157726 01
XM	.38374702 06	YM	-.10263871 04	ZM	-.38408146 05	DXM	-.85688286-03	DYM	.93575315 00	DZM	.40312693 00
XT	.38374702 06	YT	-.10263871 04	ZT	-.38408146 05	DXT	-.85688286-03	DYT	.93575315 00	DZT	.40312693 00
RS	.15188322 09	VS	.29325644 02	RM	.38566567 06	VM	.10188945 01	RT	.38566567 06	VT	.10188945 01
GED	-.50001069 00	ALT	.10217378 06	LOS	.15160107 03	RAS	.12835547 03	RAM	.35984675 03	LOM	.23092354 02
DUT	.35000000 02	DT	.95999999 03	DR	.23185644 01	SHA	.10119260 06	DES	.18780733 02	DEM	-.57155167 01

HELIOCENTRIC — EQUATORIAL COORDINATES

X	.89335634 08	Y	-.11273180 09	Z	-.48899345 08	DX	.25688850 02	DY	.17146761 02	DZ	.72161272 01
R	.15192255 09	LAT	-.18776064 02	LON	.30839548 03	V	.31717518 02	PTH	.10797419 00	AZ	.76057896 02
XE	.89231324 08	YE	-.11276183 09	ZE	-.48898404 08	DXE	.23618502 02	DYE	.15947784 02	DZE	.69157726 01
XT	.89615071 08	YT	-.11276286 09	ZT	-.48936813 08	DXT	.23617645 02	DYT	.16883537 02	DZT	.73188996 01
LTE	-.18780733 02	LOE	.30835547 03	LTT	-.18765418 02	LOT	.30847492 03	RST	.15212210 09	VST	.29940161 02
EPS	.68742859 02	ESP	.38308338-01	SEP	.11121897 03	EPM	.15656736 03	EMP	.64266308 01	MEP	.17006001 02
MPS	.13467490 03	MSP	.75652909-01	SMP	.45249126 02	SEM	.12821507 03	EMS	.51670799 02	ESM	.11471201 00
RPM	.28364263 06	SPN	.65374491 02								
GCE	.10257265 03	GCT	.28156132 03	SIP	.13432443 03	CPT	.91218539 02	SIN	.90868066 02	D1	.18350900 00
REP	.10855199 06	VEP	.24112442 01	CPE	.96604408 02	CPS	.76842463 02	D2	.12975627 00	D3	.11127990-02

0 DAYS 9 HRS. 40 MIN. 4.000 SEC. — 2356664712542020000000000 J.D.= 2438605.62500000 JULY 29,1964 03 00 00.000
TFL 0 DAYS 10 HRS. 9 MIN. 52.127 SEC.

GEOCENTRIC — EQUATORIAL COORDINATES

X	.11156386 06	Y	.34289674 05	Z	.14145645 03	DX	.19619511 01	DY	.11666457 01	DZ	.30075305 00
R	.11671460 06	DEC	.69442531-01	RA	.17085054 02	V	.23023394 01	PTH	.74488644 02	AZ	.61046696 02
R	.11671460 06	LAT	.69442531-01	LON	.25289595 02	VE	.82804863 01	PTE	.15540348 02	AZE	.27214118 03
XS	-.89316327 08	YS	.11270439 09	ZS	.48873498 08	DXS	-.23606447 02	DYS	-.15963157 02	DZS	-.69224277 01
XM	.38372644 06	YM	.23421869 04	ZM	-.36955209 05	DXM	-.10575301-01	DYM	.93566444 00	DZM	.40405566 00
XT	.38372644 06	YT	.23421869 04	ZT	-.36955209 05	DXT	-.10575301-01	DYT	.93566444 00	DZT	.40405566 00
RS	.15188254 09	VS	.29325871 02	RM	.38550895 06	VM	.10192354 01	RT	.38550895 06	VT	.10192354 01
GED	.69915766-01	ALT	.11033639 06	LOS	.13660077 03	RAS	.12839623 03	RAM	.34971507 00	LOM	.85542526 01
DUT	.35000000 02	DT	.95999999 03	DR	.22184825 01	SHA	.10960374 06	DES	.18770897 02	DEM	-.55008686 01

HELIOCENTRIC — EQUATORIAL COORDINATES

X	.89427890 08	Y	-.11267010 09	Z	-.48873356 08	DX	.25568398 02	DY	.17129803 02	DZ	.72231807 01
R	.15192269 09	LAT	-.18765695 02	LON	.30843954 03	V	.31612457 02	PTH	.41638540-01	AZ	.76020978 02
XE	.89316327 08	YE	-.11270439 09	ZE	-.48873498 08	DXE	.23606447 02	DYE	.15963157 02	DZE	.69224277 01
XT	.89700053 08	YT	-.11270205 09	ZT	-.48910453 08	DXT	.23595871 02	DYT	.16898821 02	DZT	.73264834 01
LTE	-.18770897 02	LOE	.30839623 03	LTT	-.18755375 02	LOT	.30851644 03	RST	.15211865 09	VST	.29933470 02
EPS	.69855429 02	ESP	.41377734-01	SEP	.11010323 03	EPM	.15504854 03	EMP	.73376903 01	MEP	.17613767 02
MPS	.13508688 03	MSP	.73354886-01	SMP	.44839575 02	SEM	.12771114 03	EMS	.52173982 02	ESM	.11471201 00
RPM	.27653078 06	SPN	.66722876 02								
GCE	.10239079 03	GCT	.28157443 03	SIP	.13472740 03	CPT	.91329865 02	SIN	.90970378 02	D1	.18822868 00
REP	.11671460 06	VEP	.23023394 01	CPE	.96765053 02	CPS	.76846699 02	D2	.13406039 00	D3	.11876333-02

0 DAYS 10 HRS. 40 MIN. 4.000 SEC. — 2356664730602020000000000 J.D.= 2438605.66666666 JULY 29,1964 04 00 00.000
TFL 0 DAYS 11 HRS. 9 MIN. 52.127 SEC.

GEOCENTRIC — EQUATORIAL COORDINATES

X	.11845391 06	Y	.38435300 05	Z	.12233761 04	DX	.18679676 01	DY	.11368759 01	DZ	.30018227 00
R	.12453954 06	DEC	.56283661 00	RA	.17976937 02	V	.22072379 01	PTH	.74847467 02	AZ	.61050277 02
R	.12453954 06	LAT	.56283661 00	LON	.11140404 02	VE	.88413495 01	PTE	.13943795 02	AZE	.27186505 03
XS	-.89401293 08	YS	.11264690 09	ZS	.48848564 08	DXS	-.23594378 02	DYS	-.15978524 02	DZS	-.69290798 01
XM	.38367087 06	YM	.57103020 04	ZM	-.35498986 05	DXM	-.20305276-01	DYM	.93549066 00	DZM	.40494881 00
XT	.38367087 06	YT	.57103020 04	ZT	-.35498986 05	DXT	-.20305276-01	DYT	.93549066 00	DZT	.40494881 00
RS	.15188185 09	VS	.29326099 02	RM	.38535194 06	VM	.10195777 01	RT	.38535194 06	VT	.10195777 01
GED	.56667197 00	ALT	.11816134 06	LOS	.12160045 03	RAS	.12843699 03	RAM	.85268763 00	LOM	.35401615 03
DUT	.35000000 02	DT	.95999999 03	DR	.21304997 01	SHA	.11765810 06	DES	.18761052 02	DEM	-.52856366 01

HELIOCENTRIC — EQUATORIAL COORDINATES

X	.89519746 08	Y	-.11260846 09	Z	-.48847340 08	DX	.25462346 02	DY	.17115400 02	DZ	.72292620 01
R	.15192272 09	LAT	-.18755329 02	LON	.30848346 03	V	.31520314 02	PTH	-.12998412-01	AZ	.75987300 02
XE	.89401293 08	YE	-.11264690 09	ZE	-.48848564 08	DXE	.23594378 02	DYE	.15978524 02	DZE	.69290798 01
XT	.89784963 08	YT	-.11264118 09	ZT	-.48884062 08	DXT	.23574073 02	DYT	.16914015 02	DZT	.73340286 01
LTE	-.18761052 02	LOE	.30843699 03	LTT	-.18745321 02	LOT	.30855794 03	RST	.15211518 09	VST	.29926724 02
EPS	.70819938 02	ESP	.43114612-01	SEP	.10913569 03	EPM	.15368987 03	EMP	.82356411 01	MEP	.18074484 02
MPS	.13548474 03	MSP	.70982504-01	SMP	.44444028 02	SEM	.12720681 03	EMS	.52677585 02	ESM	.11556174 00
RPM	.26973967 06	SPN	.67884386 02								
GCE	.10223579 03	GCT	.28158905 03	SIP	.13511620 03	CPT	.91435990 02	SIN	.91067452 02	D1	.19296782 00
REP	.12453954 06	VEP	.22072379 01	CPE	.96902783 02	CPS	.76850915 02	D2	.13838687 00	D3	.12655446-02

0 DAYS 11 HRS. 40 MIN. 4.000 SEC. — 2356664746642020000000000 J.D.= 2438605.70833333 JULY 29,1964 05 00 00.000
TFL 0 DAYS 12 HRS. 9 MIN. 52.127 SEC.

GEOCENTRIC — EQUATORIAL COORDINATES

X	.12502680 06	Y	.42477865 05	Z	.23019992 04	DX	.17853263 01	DY	.11093403 01	DZ	.29896470 00
R	.13206578 06	DEC	.99875636 00	RA	.18765196 02	V	.21230651 01	PTH	.75153830 02	AZ	.61059467 02
R	.13206578 06	LAT	.99875636 00	LON	.35688759 03	VE	.93838102 01	PTE	.12632388 02	AZE	.27164735 03
XS	-.89486213 08	YS	.11258934 09	ZS	.48823607 08	DXS	-.23582299 02	DYS	-.15993885 02	DZS	-.69357291 01
XM	.38358024 06	YM	.90776332 04	ZM	-.34039613 05	DXM	-.30045901-01	DYM	.93523166 00	DZM	.40580625 00
XT	.38358024 06	YT	.90776332 04	ZT	-.34039613 05	DXT	-.30045901-01	DYT	.93523166 00	DZT	.40580625 00
RS	.15188116 09	VS	.29326328 02	RM	.38519462 06	VM	.10199214 01	RT	.38519462 06	VT	.10199214 01
GED	.10055613 01	ALT	.12568758 06	LOS	.10660014 03	RAS	.12847774 03	RAM	.13556832 01	LOM	.33947808 03
DUT	.35000000 02	DT	.95999999 03	DR	.20521914 01	SHA	.12539734 06	DES	.18751197 02	DEM	-.50698359 01

HELIOCENTRIC — EQUATORIAL COORDINATES

X	.89611239 08	Y	-.11254687 09	Z	-.48821305 08	DX	.25367625 02	DY	.17103225 02	DZ	.72346938 01
R	.15192265 09	LAT	-.18744969 02	LON	.30852725 03	V	.31438472 02	PTH	-.58748163-01	AZ	.75956160 02
XE	.89486213 08	YE	-.11258934 09	ZE	-.48823607 08	DXE	.23582299 02	DYE	.15993885 02	DZE	.69357291 01
XT	.89869793 08	YT	-.11258027 09	ZT	-.48857646 08	DXT	.23552253 02	DYT	.16929116 02	DZT	.73415354 01
LTE	-.18751197 02	LOE	.30847774 03	LTT	-.18735261 02	LOT	.30859942 03	RST	.15211169 09	VST	.29919922 02
EPS	.71667533 02	ESP	.45863470-01	SEP	.10828517 03	EPM	.15245999 03	EMP	.91212867 01	MEP	.18418713 02
MPS	.13586939 03	MSP	.67810450-01	SMP	.44061568 02	SEM	.12670206 03	EMS	.53181608 02	ESM	.11556174 00
RPM	.26322265 06	SPN	.68899408 02								
GCE	.10210157 03	GCT	.28160485 03	SIP	.13549173 03	CPT	.91537429 02	SIN	.91159768 02	D1	.19774564 00
REP	.13206578 06	VEP	.21230651 01	CPE	.97022681 02	CPS	.76855113 02	D2	.14274988 00	D3	.13468570-02

0 DAYS 12 HRS. 40 MIN. 4.000 SEC. — 2356664764702020000000000 J.D.= 2438605.75000000 JULY 29,1964 06 00 00.000
TFL 0 DAYS 13 HRS. 9 MIN. 52.127 SEC.

GEOCENTRIC — EQUATORIAL COORDINATES

X	.13131918 06	Y	.46424890 05	Z	.33753994 04	DX	.17118100 01	DY	.10837566 01	DZ	.29730888 00
R	.13932477 06	DEC	.13882308 01	RA	.19469883 02	V	.20477339 01	PTH	.75418191 02	AZ	.61072365 02
R	.13932476 06	LAT	.13882308 01	LON	.34255121 03	VE	.99089235 01	PTE	.11536901 02	AZE	.27147181 03
XS	-.89571086 08	YS	.11253174 09	ZS	.48798629 08	DXS	-.23570209 02	DYS	-.16009238 02	DZS	-.69423756 01
XM	.38345452 06	YM	.12443873 05	ZM	-.32577221 05	DXM	-.39796321-01	DYM	.93488721 00	DZM	.40662782 00
XT	.38345452 06	YT	.12443873 05	ZT	-.32577221 05	DXT	-.39796321-01	DYT	.93488721 00	DZT	.40662782 00
RS	.15188047 09	VS	.29326558 02	RM	.38503700 06	VM	.10202666 01	RT	.38503700 06	VT	.10202666 01
GED	.13976876 01	ALT	.13294657 06	LOS	.91599824 02	RAS	.12851849 03	RAM	.18587139 01	LOM	.32494005 03
DUT	.35000000 02	DT	.19200000 04	DR	.19817747 01	SHA	.13285507 06	DES	.18741334 02	DEM	-.48534862 01

HELIOCENTRIC — EQUATORIAL COORDINATES

X	.89702405 08	Y	-.11248531 09	Z	-.48795253 08	DX	.25282019 02	DY	.17092994 02	DZ	.72396845 01
R	.15192249 09	LAT	-.18734614 02	LON	.30857092 03	V	.31365011 02	PTH	-.97579496-01	AZ	.75927051 02
XE	.89571086 08	YE	-.11253174 09	ZE	-.48798629 08	DXE	.23570209 02	DYE	.16009238 02	DZE	.69423756 01
XT	.89954540 08	YT	-.11251929 09	ZT	-.48831205 08	DXT	.23530412 02	DYT	.16944125 02	DZT	.73490033 01
LTE	-.18741334 02	LOE	.30851849 03	LTT	-.18725192 02	LOT	.30864089 03	RST	.15210818 09	VST	.29913066 02
EPS	.72420751 02	ESP	.47949227-01	SEP	.10752914 03	EPM	.15133598 03	EMP	.99953578 01	MEP	.18668654 02
MPS	.13624169 03	MSP	.66719594-01	SMP	.43691371 02	SEM	.12619690 03	EMS	.53686057 02	ESM	.11703392 00
RPM	.25694266 06	SPN	.69796952 02								
GCE	.10198383 03	GCT	.28162160 03	SIP	.13585479 03	CPT	.91634609 02	SIN	.91247717 02	D1	.20257900 00
REP	.13932477 06	VEP	.20477339 01	CPE	.97128369 02	CPS	.76859295 02	D2	.14716213 00	D3	.14319009-02

0 DAYS 13 HRS. 40 MIN. 4.000 SEC. 2356665002742020000000000 J.D.= 2438605.79166666 JULY 29,1964 07 00 00.000
TFL 0 DAYS 14 HRS. 9 MIN. 52.127 SEC.

GEOCENTRIC — EQUATORIAL COORDINATES

X	.13736079 06	Y	.50282966 05	Z	.44422671 04	DX	.16457714 01	DY	.10598851 01	DZ	.29535378 00
R	.14634239 06	DEC	.17394963 01	RA	.20105907 02	V	.19796852 01	PTH	.75648275 02	AZ	.61087704 02
R	.14634239 06	LAT	.17394963 01	LON	.32814617 03	VE	.10417800 02	PTE	.10608592 02	AZE	.27132760 03
XS	-.89655919 08	YS	.11247408 09	ZS	.48773624 08	DXS	-.23558106 02	DYS	-.16024585 02	DZS	-.69490191 01
XM	.38329368 06	YM	.15808725 05	ZM	-.31111934 05	DXM	-.49555712-01	DYM	.93445717 00	DZM	.40741333 00
XT	.38329368 06	YT	.15808725 05	ZT	-.31111934 05	DXT	-.49555712-01	DYT	.93445717 00	DZT	.40741333 00
RS	.15187978 09	VS	.29326789 02	RM	.38487909 06	VM	.10206133 01	RT	.38487909 06	VT	.10206133 01
GED	.17513433 01	ALT	.13996421 06	LOS	.76599500 02	RAS	.12855923 03	RAM	.23617949 01	LOM	.31040206 03
DUT	.35000000 02	DT	.19200000 04	DR	.19179040 01	SHA	.14005888 06	DES	.18731462 02	DEM	-.46365979 01

HELIOCENTRIC — EQUATORIAL COORDINATES

X	.89793279 08	Y	-.11242379 09	Z	-.48769181 08	DX	.25203877 02	DY	.17084470 02	DZ	.72443729 01
R	.15192227 09	LAT	-.18724260 02	LON	.30861448 03	V	.31298490 02	PTH	-.13091338 00	AZ	.75899603 02
XE	.89655919 08	YE	-.11247408 09	ZE	-.48773624 08	DXE	.23558106 02	DYE	.16024585 02	DZE	.69490191 01
XT	.90039212 08	YT	-.11245827 09	ZT	-.48804735 08	DXT	.23508550 02	DYT	.16959042 02	DZT	.73564324 01
LTE	-.18731462 02	LOE	.30855923 03	LTT	-.18715114 02	LOT	.30868236 03	RST	.15210465 09	VST	.29906156 02
EPS	.73096383 02	ESP	.51869734-01	SEP	.10685079 03	EPM	.15030056 03	EMP	.10858536 02	MEP	.18840895 02
MPS	.13660238 03	MSP	.63719410-01	SMP	.43332694 02	SEM	.12569132 03	EMS	.54190928 02	ESM	.11724273 00
RPM	.25086961 06	SPN	.70598487 02								
GCE	.10187946 03	GCT	.28163909 03	SIP	.13620611 03	CPT	.91727888 02	SIN	.91331629 02	D1	.20748326 00
REP	.14634239 06	VEP	.19796852 01	CPE	.97222514 02	CPS	.76863466 02	D2	.15163549 00	D3	.15210205-02

0 DAYS 14 HRS. 40 MIN. 4.000 SEC. 2356665021C0202000000000 J.D.= 2438605.83333333 JULY 29,1964 08 00 00.000
TFL 0 DAYS 15 HRS. 9 MIN. 52.127 SEC.

GEOCENTRIC — EQUATORIAL COORDINATES

X	.14317620 06	Y	.54057874 05	Z	.55017041 04	DX	.15859568 01	DY	.10375227 01	DZ	.29319434 00
R	.15314028 06	DEC	.20588452 01	RA	.20684626 02	V	.19177266 01	PTH	.75849983 02	AZ	.61104602 02
R	.15314028 06	LAT	.20588452 01	LON	.31368383 03	VE	.10911517 02	PTE	.98122419 01	AZE	.27120727 03
XS	-.89740704 08	YS	.11241636 09	ZS	.48748598 08	DXS	-.23545993 02	DYS	-.16039925 02	DZS	-.69556597 01
XM	.38309771 06	YM	.19171862 05	ZM	-.29643890 05	DXM	-.59323158-01	DYM	.93394135 00	DZM	.40816265 00
XT	.38309771 06	YT	.19171862 05	ZT	-.29643890 05	DXT	-.59323158-01	DYT	.93394135 00	DZT	.40816265 00
RS	.15187909 09	VS	.29327021 02	RM	.38472090 06	VM	.10209615 01	RT	.38472090 06	VT	.10209615 01
GED	.20728636 01	ALT	.14676210 06	LOS	.61599175 02	RAS	.12859997 03	RAM	.28649386 01	LOM	.29586414 03
DUT	.35000000 02	DT	.19200000 04	DR	.18595408 01	SHA	.14703179 06	DES	.18721582 02	DEM	-.44191904 01

HELIOCENTRIC — EQUATORIAL COORDINATES

X	.89883880 08	Y	-.11236230 09	Z	-.48743096 08	DX	.25131949 02	DY	.17077447 02	DZ	.72488540 01
R	.15192198 09	LAT	-.18713910 02	LON	.30865795 03	V	.31237797 02	PTH	-.15979996 00	AZ	.75873531 02
XE	.89740704 08	YE	-.11241636 09	ZE	-.48748598 08	DXE	.23545993 02	DYE	.16039925 02	DZE	.69556597 01
XT	.90123801 08	YT	-.11239719 09	ZT	-.48778242 08	DXT	.23486669 02	DYT	.16973866 02	DZT	.73638222 01
LTE	-.18721582 02	LOE	.30859997 03	LTT	-.18705031 02	LOT	.30872380 03	RST	.15210110 09	VST	.29899191 02
EPS	.73707238 02	ESP	.55514057-01	SEP	.10623731 03	EPM	.14934044 03	EMP	.11711433 02	MEP	.18948115 02
MPS	.13695213 03	MSP	.61770341-01	SMP	.42984873 02	SEM	.12518533 03	EMS	.54696225 02	ESM	.11786692 00
RPM	.24497873 06	SPN	.71320289 02								
GCE	.10178610 03	GCT	.28165718 03	SIP	.13654634 03	CPT	.91817574 02	SIN	.91411787 02	D1	.21247275 00
REP	.15314028 06	VEP	.19177266 01	CPE	.97307128 02	CPS	.76867627 02	D2	.15618124 00	D3	.16145788-02

0 DAYS 15 HRS. 40 MIN. 4.000 SEC. 2356665037042020000000000 J.D.= 2438605.87500000 JULY 29,1964 09 00 00.000
TFL 0 DAYS 16 HRS. 9 MIN. 52.127 SEC.

GEOCENTRIC — EQUATORIAL COORDINATES

X	.14878597 06	Y	.57754737 05	Z	.65531033 04	DX	.15313925 01	DY	.10164977 01	DZ	.29089677 00
R	.15973672 06	DEC	.23511842 01	RA	.21214883 02	V	.18609276 01	PTH	.76027860 02	AZ	.61122447 02
R	.15973671 06	LAT	.23511842 01	LON	.29917302 03	VE	.11391079 02	PTE	.91217926 01	AZE	.27110551 03
XS	-.89825452 08	YS	.11235859 09	ZS	.48723545 08	DXS	-.23533866 02	DYS	-.16055259 02	DZS	-.69622974 01
XM	.38286655 06	YM	.22533003 05	ZM	-.28173205 05	DXM	-.69097876-01	DYM	.93333960 00	DZM	.40887559 00
XT	.38286655 06	YT	.22533003 05	ZT	-.28173205 05	DXT	-.69097876-01	DYT	.93333960 00	DZT	.40887559 00
RS	.15187839 09	VS	.29327253 02	RM	.38456243 06	VM	.10213112 01	RT	.38456243 06	VT	.10213112 01
GED	.23671888 01	ALT	.15335854 06	LOS	.46598846 02	RAS	.12864071 03	RAM	.33681669 01	LOM	.28132631 03
DUT	.35000000 02	DT	.19200000 04	DR	.18058688 01	SHA	.15379327 06	DES	.18711692 02	DEM	-.42012766 01

HELIOCENTRIC — EQUATORIAL COORDINATES

X	.89974237 08	Y	-.11230083 09	Z	-.48716991 08	DX	.25065259 02	DY	.17071757 02	DZ	.72531942 01
R	.15192164 09	LAT	-.18703559 02	LON	.30870134 03	V	.31182060 02	PTH	-.18503665 00	AZ	.75848618 02
XE	.89825452 08	YE	-.11235859 09	ZE	-.48723545 08	DXE	.23533866 02	DYE	.16055259 02	DZE	.69622974 01
XT	.90208318 08	YT	-.11233605 09	ZT	-.48751718 08	DXT	.23464768 02	DYT	.16988599 02	DZT	.73711730 01
LTE	-.18711692 02	LOE	.30864C71 03	LTT	-.18694938 02	LOT	.30876523 03	RST	.15209753 09	VST	.29892173 02
EPS	.74263292 02	ESP	.57674939-01	SEP	.10567870 03	EPM	.14844513 03	EMP	.12554644 02	MEP	.19000217 02
MPS	.13729156 03	MSP	.60165642-01	SMP	.42647307 02	SEM	.12467892 03	EMS	.55201948 02	ESM	.11889995 00
RPM	.23924925 06	SPN	.71974967 02								
GCE	.10170195 03	GCT	.28167573 03	SIP	.13687605 03	CPT	.91903935 02	SIN	.91488431 02	D1	.21756126 00
REP	.15973672 06	VEP	.18609276 01	CPE	.97383762 02	CPS	.76871777 02	D2	.16081042 00	D3	.17129640-02

0 DAYS 16 HRS. 40 MIN. 4.000 SEC. 2356665055102020000000C00 J.D.= 2438605.91666666 JULY 29,1964 10 00 00.000
TFL 0 DAYS 17 HRS. 9 MIN. 52.127 SEC.

GEOCENTRIC — EQUATORIAL COORDINATES

X	.15420759 06	Y	.61378092 05	Z	.75960550 04	DX	.14813088 01	DY	.99666358 00	DZ	.28850785 00
R	.16614737 06	DEC	.26204C46 01	RA	.21703671 02	V	.18085493 01	PTH	.76185527 02	AZ	.61140798 02
R	.16614737 06	LAT	.26204C46 01	LON	.28462074 03	VE	.11857411 02	PTE	.85175813 01	AZE	.27101845 03
XS	-.89910155 08	YS	.11230076 09	ZS	.48698467 08	DXS	-.23521729 02	DYS	-.16070587 02	DZS	-.69689323 01
XM	.38260020 06	YM	.25891824 05	ZM	-.26700020 05	DXM	-.78878950-01	DYM	.93265176 00	DZM	.40955202 00
XT	.38260020 06	YT	.25891824 05	ZT	-.26700020 05	DXT	-.78878950-01	DYT	.93265176 00	DZT	.40955202 00
RS	.15187770 09	VS	.29327487 02	RM	.38440368 06	VM	.10216624 01	RT	.38440368 06	VT	.10216624 01
GED	.26382369 01	ALT	.15976921 06	LOS	.31598511 02	RAS	.12868144 03	RAM	.38714916 01	LOM	.26678856 03
DUT	.35000000 02	DT	.19200000 04	DR	.17562353 01	SHA	.16035997 06	DES	.18701792 02	DEM	-.39828728 01

HELIOCENTRIC — EQUATORIAL COORDINATES

X	.90064362 08	Y	-.11223938 09	Z	-.48690871 08	DX	.25003038 02	DY	.17067250 02	DZ	.72574401 01
R	.15192125 09	LAT	-.18693208 02	LON	.30874464 03	V	.31130585 02	PTH	-.20723733 00	AZ	.75826492 02
XE	.89910155 08	YE	-.11230076 09	ZE	-.48698467 08	DXE	.23521729 02	DYE	.16070587 02	DZE	.69689323 01
XT	.90292755 08	YT	-.11227486 09	ZT	-.48725168 08	DXT	.23442850 02	DYT	.17003238 02	DZT	.73784843 01
LTE	-.18701792 02	LOE	.30868144 03	LTT	-.18684836 02	LOT	.30880665 03	RST	.15209394 09	VST	.29885102 02
EPS	.74772452 02	ESP	.59347024-01	SEP	.10516707 03	EPM	.14760627 03	EMP	.13388677 02	MEP	.19005045 02
MPS	.13762122 03	MSP	.58933450-01	SMP	.42319448 02	SEM	.12417209 03	EMS	.55708100 02	ESM	.11951548 00
RPM	.23366361 06	SPN	.72572464 02								
GCE	.10162561 03	GCT	.28169465 03	SIP	.13719578 03	CPT	.91987205 02	SIN	.91561767 02	D1	.22276227 00
REP	.16614737 06	VEP	.18085493 01	CPE	.97453627 02	CPS	.76875922 02	D2	.16553398 00	D3	.18165940-02

0 DAYS 17 HRS. 7 MIN. 13.000 SEC. 2356665063372022000000C00 J.D.= 2438605.93552083 JULY 29,1964 10 27 09.000
TFL 0 DAYS 17 HRS. 37 MIN. 1.127 SEC.

GEOCENTRIC — EQUATORIAL COORDINATES

X	.15660314 06	Y	.62994607 05	Z	.80651379 04	DX	.14599478 01	DY	.98804557 00	DZ	.28740624 00
R	.16899086 06	DEC	.27354959 01	RA	.21912772 02	V	.17861366 01	PTH	.76251031 02	AZ	.61149168 02
R	.16899086 06	LAT	.27354959 01	LON	.27802376 03	VE	.12064308 02	PTE	.82683246 01	AZE	.27098308 03
XS	-.89948465 08	YS	.11227458 09	ZS	.48687116 08	DXS	-.23516234 02	DYS	-.16077519 02	DZS	-.69719336 01
XM	.38246810 06	YM	.27410829 05	ZM	-.26032624 05	DXM	-.83306693-01	DYM	.93231218 00	DZM	.40984608 00
XT	.38246810 06	YT	.27410829 05	ZT	-.26032624 05	DXT	-.83306693-01	DYT	.93231218 00	DZT	.40984608 00
RS	.15187739 09	VS	.29327593 02	RM	.38433176 06	VM	.10218218 01	RT	.38433176 06	VT	.10218218 01
GED	.27541091 01	ALT	.16261270 06	LOS	.24810858 02	RAS	.12869987 03	RAM	.40992793 01	LOM	.26021027 03
DUT	.35000000 02	DT	.19200000 04	DR	.17349573 01	SHA	.16327133 06	DES	.18697310 02	DEM	-.38838905 01

HELIOCENTRIC — EQUATORIAL COORDINATES

X	.90105068 08	Y	-.11221158 09	Z	-.48679050 08	DX	.24976181 02	DY	.17065565 02	DZ	.72593398 01
R	.15192107 09	LAT	-.18688525 02	LON	.30876420 03	V	.31108538 02	PTH	-.21641881 00	AZ	.75814153 02
XE	.89948465 08	YE	-.11227458 09	ZE	-.48687116 08	DXE	.23516234 02	DYE	.16077519 02	DZE	.69719336 01
XT	.90330933 08	YT	-.11224716 09	ZT	-.48713148 08	DXT	.23432927 02	DYT	.17009831 02	DZT	.73817797 01
LTE	-.18697310 02	LOE	.30869986 03	LTT	-.18680264 02	LOT	.30882538 03	RST	.15209232 09	VST	.29881885 02
EPS	.74989193 02	ESP	.61373100-01	SEP	.10494923 03	EPM	.14724336 03	EMP	.13763194 02	MEP	.18993440 02
MPS	.13776732 03	MSP	.58933450-01	SMP	.42174144 02	SEM	.12394261 03	EMS	.55937274 02	ESM	.12012787 00
RPM	.23117924 06	SPN	.72826240 02								
GCE	.10159332 03	GCT	.28170332 03	SIP	.13733730 03	CPT	.92023927 02	SIN	.91593917 02	D1	.22515631 00
REP	.16899086 06	VEP	.17861366 01	CPE	.97483286 02	CPS	.76877794 02	D2	.16770539 00	D3	.18653308-02

2 DAYS 19 HRS. 23 MIN. 44.933 SEC. 2356666366372021673325l1 J.D.= 2438608.03033487 JULY 31,1964 12 43 40.933
TFL 2 DAYS 19 HRS. 53 MIN. 33.060 SEC.

GEOCENTRIC — EQUATORIAL COORDINATES

X	.32423682 06	Y	.18747958 06	Z	.48415612 05	DX	.11899592 01	DY	-.10553151 01	DZ	-.28984795 00
R	.37765352 06	DEC	.73656563 01	RA	.30037273 02	V	.16166956 01	PTH	.16552819 02	AZ	.25687876 03
R	.37765351 06	LAT	.73656563 01	LON	.24995051 03	VE	.28826744 02	PTE	.91551257 00	AZE	.26930065 03
XS	-.94148619 08	YS	.10929542 09	ZS	.47395290 08	DXS	-.22890601 02	DYS	-.16839264 02	DZS	-.73016810 01
XM	.32335553 06	YM	.18600810 06	ZM	.48150340 05	DXM	-.56216485 00	DYM	.78362970 00	DZM	.39332854 00
XT	.32335553 06	YT	.18600810 06	ZT	.48150340 05	DXT	-.56216485 00	DYT	.78362970 00	DZT	.39332854 00
RS	.15184125 09	VS	.29340329 02	RM	.37613331 06	VM	.10415432 01	RT	.37613331 06	VT	.10415432 01
GED	.74152949 01	ALT	.37127567 06	LOS	.35065531 03	RAS	.13074207 03	RAM	.29909375 02	LOM	.24982261 03
DUT	.35000000 02	DT	.59999999 02	DR	.46059519 00	SHA	.37419654 06	DES	.18188070 02	DEM	.73548466 01

HELIOCENTRIC — EQUATORIAL COORDINATES

X	.94472856 08	Y	-.10910794 09	Z	-.47346875 08	DX	.24080560 02	DY	.15783949 02	DZ	.70118330 01
R	.15189269 09	LAT	-.18162472 02	LON	.31088817 03	V	.29633970 02	PTH	.28119137 01	AZ	.74607190 02
XE	.94148619 08	YE	-.10929542 09	ZE	-.47395290 08	DXE	.22890601 02	DYE	.16839264 02	DZE	.73016810 01
XT	.94471975 08	YT	-.10910941 09	ZT	-.47347141 08	DXT	.22328436 02	DYT	.17622893 02	DZT	.76950095 01
LTE	-.18188070 02	LOE	.31074208 03	LTT	-.18162504 02	LOT	.31088753 03	RST	.15189328 09	VST	.29467585 02
EPS	.82100467 02	ESP	.14162004 00	SEP	.97758377 02	EPM	.28784700 02	EMP	.15108799 03	MEP	.12724677 00
MPS	.10992753 03	MSP	.27453512-18	SMP	.70071851 02	SEM	.97881501 02	EMS	.81977955 02	ESM	.14075386 00
RPM	.17355999 04	SPN	.81132781 02								
GCE	.10048671 03	GCT	.10796722 03	SIP	.21434090 02	CPT	.11102878 03	SIN	.22535339 02	D1	.11406909 04
REP	.37765352 06	VEP	.16166956 01	CPE	.98337669 02	CPS	.77086569 02	D2	.16978404 03	D3	.15724741 05

SELENOCENTRIC — EQUATORIAL COORDINATES

X	.88129493 03	Y	.14714812 04	Z	.26527224 03	DX	.17521241 01	DY	-.18389448 01	DZ	-.68317650 00
R	.17355999 04	DEC	.87916512 01	RA	.59081898 02	V	.26302826 01	PTH	-.17109632 02	AZ	.25685680 03
R	.17355998 04	LAT	-.12166318 02	LON	.20340645 03	VP	.26346417 01	PTP	-.17080452 02	AZP	.26757569 03
LTS	.94222630 00	LNS	.27278050 03	LTE	.58681954 01	LNE	.35481263 03				
ALT	.59994507 00	SHA	-.16316736 04	ALP	.17580840 03	DR	-.77383181 00	DP	.82988284-01	ASD	.88493441 02
HGE	.27789953 03	SVL	-.70302778 01	HNG	.24991503 03	SIA	-.59708741 02				

SELENOCENTRIC CONIC

EPOCH OF PERICENTER PASSAGE 2356666367562023257603l1 J.D.= 2438608.03400082 JULY 31,1964 12 48 57.672

SMA	-.38639872 04	ECC	.14159395 01	B	.38734127 04	SLR	.38828616 04	APO	.00000000 00	RCA	.16071850 04
VH	.11264181 01	C3	.12688178 01	C1	.43630825 04	TFP	-.31673861 03	TF	.67483795 02	LTF	.67152395 02
TA	-.29101803 02	MTA	.13493020 03	EA	-.12389662 02	MA	-.52903887 01	C3J	-.19274104 01	TFI	.67395814 02
ZAE	.13386468 03	ZAP	.14411525 03	ZAC	.93066534 02	DEF	.89860404 02	IR	.40519452 04	GP	.83246857 00
OP1	.78995323 01	OY	-.26064495 01	OP2	.26957408 02						

ALL VECTORS REFERENCED TO EARTH EQUATOR PLANE

X	.88129493 03	Y	.14714812 04	Z	.26527224 03	DX	.17521241 01	DY	-.18389448 01	DZ	-.68317650 00
INC	.16423059 03	LAN	.20587461 03	APF	.17487974 03	MX	.85328672 00	MY	-.47053737 00	MZ	-.22471383 00
WX	-.11859573 00	WY	.24452204 00	WZ	-.96236326 00	PX	.85867921 00	PY	.51193922 00	PZ	.24254149-01
QX	.49860216 00	QY	-.82348481 00	QZ	-.27068185 00	RX	-.17003426 00	RY	.39245544-01	RZ	-.98465634 00
BX	.25578187 00	BY	.94401832 00	BZ	.20833882 00	TX	-.22489689 00	TY	-.97438257 00	TZ	.00000000 00
SXI	.95943198 00	SYI	-.22144615 00	SZI	-.17450462 00	DAI	-.10049833 02	RAI	.34700318 03		
SXO	-.25344359 00	SYO	-.94455504 00	SZO	-.20876335 00	DAO	-.12049891 02	RAO	.25498014 03		
ETE	.20052762 03	ETS	.17164485 02	ETC	.30508904 03						
BTQ	-.37857169 04	BRQ	-.81955720 03	B	.38734127 04	THA	.19221527 03				

ALL VECTORS REFERENCED TO ORBIT PLANE OF TARGET

X	-.73515624 03	Y	-.15509747 04	Z	-.25754600 03	DX	-.19492724 01	DY .17469618 01	DZ .25854990 00
INC	.17084982 03	LAN	.17595697 03	APF	.32017221 03	MX	.86127904 00	MY -.50302756 00	MZ -.71041039-01
WX	.11211956-01	WY	.15862682 00	WZ	-.98727494 00	PX	-.81064478 00	PY -.57661202 00	PZ -.10185110 00
QX	-.58543090 00	QY	.80147123 00	QZ	.12212505 00	RX	-.14341097-01	RY .23275524-02	RZ -.99989443 00
BX	-.16045259 00	BY	-.97425761 00	BZ	-.15835748 00	TX	.16020322 00	TY .98708405 00	TZ .00000000 00
SXI	-.98697986 00	SYI	.16018631 00	SZI	.14528749-01	DAI	.83246516 00	RAI .17078130 03	
SXO	.15804769 00	SYO	.97464496 00	SZO	.15839240 00	DAO	.91135981 01	RAO .80789132 02	
ETE	.16270409 03	ETS	.32633398 03	ETC	.26124023 03				
BTO	-.38245276 04	BRO	.61344869 03	B	.38734133 04	THA	.17088745 03		

ALL VECTORS REFERENCED TO TRUE LUNAR EQU. PLANE

X	-.15570033 04	Y	-.67398376 03	Z	-.36577796 03	DX	-.28293685 00	DY .26143560 01	DZ .58949589-01
INC	.16759721 03	LAN	.10202748 03	APF	.28798169 03	MX	.83487689 00	MY -.52803198 00	MZ .15537392 00
WX	.21006774 00	WY	.44756613-01	WZ	-.97666186 00	PX	-.97289418 00	PY .10835946 00	PZ -.20429167 00
QX	.96687149-01	QY	.99310374 00	QZ	.66306277-01	RX	.60505079-01	RY -.76247537-01	RZ -.99525142 00
BX	-.75706221 00	BY	-.62465972 00	BZ	-.19146033 00	TX	.78333312 00	TY .62160215 00	TZ .00000000 00
SXI	-.61865041 00	SYI	.77961340 00	SZI	-.97337307-01	DAI	-.55858627 01	RAI .12843322 03	
SXO	.75555311 00	SYO	.62655671 00	SZO	.19122267 00	DAO	.11024147 02	RAO .39667863 02	
ETE	.51934452 00	ETS	.18133279 03	ETC	.25517839 03				
BTT	-.38010655 04	BRT	.74514347 03	B	.38734142 04	THA	.16890865 03		

615457037246 615405732311 613546531C03 203702012004 603671143305 603462416420

640702817 1956000 000000000000

APPENDIX C

Ranger VII space trajectory for postmaneuver orbit

SPACE TRAJECTORY
RA-7 POST MIDCOURSE ORBIT

GME	.39860138 06	J	.16234500-02	H	-.57499999-05	D	.78749999-05	RE	.63781650 04	REM	.63783079 04
G	.66709998-19	A	.88782497 29	B	.88800499 29	C	.88837498 29	OME	.41780741-02	AU	.14959900 09
GMM	.49025900 04	GMS	.13271544 12	GMV	.3247695C C6	GMA	.42977799 05	GMC	.37918700 08	GMJ	.12671C60 09
EGM	.39860320 06	MGM	.49027779 C4	JA	.292C0C0C-02	HA	.00000000 00	DA	.00000000 00	RA	.34170000 04
ARA	.35670000 01	GB	.39224C36 0C	MAS	.37410000 03	GB1	.00000000 00	GB2	.00000000 00	SC	.10200000 09

INJECTION CONDITIONS MOON 2356665063532024000000000 J.D.= 2438605.93608796 JULY 29,1964 10 27 58.000

GEOCENTRIC X0 .15667452 06 Y0 .63041633 C5 Z0 .80776772 04 DX0 .14342616 01 DY0 .97257020 00 DZ0 .28116151 00
CARTESIAN GMC .00000C0C0 00 SGC .CC0C0C0C 00 T0 .37678000 05 GHA .10409373 03 GH0 .30667227 03

0 DAYS 0 HRS. 0 MIN. 0.000 SEC. 2356665063532024000000C0 J.D.= 2438605.93608796 JULY 29,1964 10 27 58.000
TFL 0 DAYS 17 HRS. 37 MIN. 50.127 SEC.

GEOCENTRIC EQUATORIAL COORDINATES

X	.15667451 06	Y	.63041630 05	Z	.80776771 04	DX	.14342615 01	DY	.97257015 00	DZ	.28116150 00
R	.16907512 06	DEC	.27383859 01	RA	.21918536 02	V	.17555770 01	PTH	.76231923 02	AZ	.61412209 02
R	.16907512 06	LAT	.27383859 01	LCN	.27782480 03	VE	.12070910 02	PTE	.81207516 01	AZE	.27095862 03
XS	-.89949617 08	YS	.11227379 09	ZS	.48686774 08	DXS	-.23516068 02	DYS	-.16077728 02	DZS	-.69720238 01
XM	.38246389 06	YM	.27456503 05	ZM	-.26012533 05	DXM	-.83439898-01	DYM	.93230139 00	DZM	.40985468 00
XT	.38246389 06	YT	.27456503 05	ZT	-.26012533 05	DXT	-.83439898-01	DYT	.93230139 00	DZT	.40985468 00
RS	.15187738 09	VS	.29327596 02	RM	.38432947 06	VM	.10218263 01	RT	.38432947 06	VT	.10218263 01
GED	.27570187 01	ALT	.16269697 06	LOS	.246C6686 02	RAS	.12870042 03	RAM	.41061312 01	LOM	.26001239 03
DUT	.35000000 02	DT	.48000000 03	DR	.17051341 01	SHA	.16335720 06	DES	.18697176 02	DEM	-.38809100 01

GEOCENTRIC CONIC

EPOCH OF PERICENTER PASSAGE 2356664SC0622026265400C0 J.D.= 2438605.21642566 JULY 28,1964 17 11 39.177

SMA	.24408705 06	ECC	.97401691 00	B	.55279668 05	SLR	.12519482 05	APO	.48183196 06	RCA	.63421350 04
VH	.14661113 00	C3	-.16330296 01	C1	.70641933 05	TFP	.62178823 05	TF	-.17271895 02	PER	.20002134 05
TA	.16192552 03	MTA	.00000000 00	EA	.716C8135 02	MA	.18651656 02	C3J	-.20370907 01	TFI	.00000000 00

ALL VECTORS REFERENCED TO EARTH EQUATOR PLANE

X	.15667451 06	Y	.63041630 05	Z	.80776771 04	DX	.14342615 01	DY	.97257015 00	DZ	.28116150 00
INC	.28707653 02	LAN	.16908152 02	APF	.20378266 03	MX	-.34898679 00	MY	.80607913 00	MZ	.47795822 00
WX	.13970132 00	WY	-.45957602 C0	WZ	.877C8201 00	PX	-.77265534 00	PY	-.60455082 00	PZ	-.19370604 00
QX	.61926340 00	QY	-.65C62103 0C	QZ	-.43955C38 00	RX	.15255750 00	RY	.11936598 00	RZ	-.98105960 00
BX	-.61926358 00	BY	.65062122 00	BZ	.43955052 00	TX	-.61622231 00	TY	.78757226 00	TZ	.00000000 00
DAP	-.11169144 02	RAP	.218C4C79 03								
BTQ	.49420867 05	BRQ	-.24767310 05	B	.55279668 C5	THA	.33338222 03				

HELIOCENTRIC EQUATORIAL COORDINATES

X	.90106291 08	Y	-.11221C75 09	Z	-.48678696 C8	DX	.24950329 02	DY	.17050298 02	DZ	.72531853 01
R	.15192106 09	LAT	-.18688384 02	LON	.3087648C 03	V	.31077970 02	PTH	-.21990135 00	AZ	.75813411 02
XE	.89949617 08	YE	-.11227379 09	ZE	-.48686774 08	DXE	.23516068 02	DYE	.16077728 02	DZE	.69720238 01
XT	.90332080 08	YT	-.11224633 09	ZT	-.48712787 08	DXT	.23432628 02	DYT	.17010029 02	DZT	.73818785 01
LTE	-.18697176 02	LOE	.30870042 03	LTT	-.18680127 02	LOT	.30882594 03	RST	.15209227 09	VST	.29881788 02
EPS	.74995023 02	ESP	.60570802-01	SEP	.10494336 03	EPM	.14723360 03	EMP	.13773992 02	MEP	.18992397 02
MPS	.13777124 03	MSP	.57674939-01	SMP	.42170244 02	SEM	.12393571 03	EMS	.55944169 02	ESM	.11992408 00
RPM	.23110450 06	SPN	.72833151 02								
GCE	.10159271 03	GCT	.28170321 03	SIP	.13734109 03	CPT	.92025127 02	SIN	.91594978 02	D1	.22522914 00
REP	.16907512 06	VEP	.17555770 01	CPE	.97484329 02	CPS	.76877848 02	D2	.16777019 00	D3	.18667930-02

0 DAYS 0 HRS. 32 MIN. 2.000 SEC. 2356665073142020000000000 J.D.= 2438605.95833333 JULY 29,1964 11 00 00.000
TFL 0 DAYS 18 HRS. 9 MIN. 52.127 SEC.

GEOCENTRIC EQUATORIAL COORDINATES

X	.15940771 06	Y	.64901358 05	Z	.86168121 04	DX	.14100239 01	DY	.96267305 00	DZ	.27985019 00
R	.17232891 06	DEC	.28661053 01	RA	.22153237 02	V	.17300933 01	PTH	.76296975 02	AZ	.61421977 02
R	.17232891 06	LAT	.28661053 01	LON	.270C2925 03	VE	.12307687 02	PTE	.78493600 01	AZE	.27092133 03
XS	-.89994810 08	YS	.11224288 09	ZS	.48673370 08	DXS	-.23509580 02	DYS	-.16085906 02	DZS	-.69755642 01
XM	.38229850 06	YM	.29247986 05	ZM	-.25224465 05	DXM	-.88665452-01	DYM	.93187739 00	DZM	.41019167 00
XT	.38229850 06	YT	.29247986 05	ZT	-.25224465 05	DXT	-.88665452-01	DYT	.93187739 00	DZT	.41019167 00
RS	.15187701 09	VS	.29327722 02	RM	.38424454 06	VM	.10220148 01	RT	.38424454 06	VT	.10220148 01
GED	.28856042 01	ALT	.16595076 06	LOS	.16598171 02	RAS	.12872216 03	RAM	.43749252 01	LOM	.25225093 03
DUT	.35000000 02	DT	.20000000 01	DR	.168C849C 01	SHA	.16668788 06	DES	.18691886 02	DEM	-.37639968 01

HELIOCENTRIC EQUATORIAL COORDINATES

X	.90154217 08	Y	-.11217798 09	Z	-.48664754 08	DX	.24919604 02	DY	.17048579 02	DZ	.72554144 01
R	.15192083 09	LAT	-.18682863 02	LON	.30878784 03	V	.31052886 02	PTH	-.23016115 00	AZ	.75801190 02
XE	.89994810 08	YE	-.11224288 09	ZE	-.48673370 08	DXE	.23509580 02	DYE	.16085906 02	DZE	.69755642 01
XT	.90377108 08	YT	-.11221363 09	ZT	-.48698594 08	DXT	.23420915 02	DYT	.17017784 02	DZT	.73857559 01
LTE	-.18691886 02	LOE	.30872216 03	LTT	-.18674727 02	LOT	.30884805 03	RST	.15209035 09	VST	.29877979 02
EPS	.75236712 02	ESP	.63334395-01	SEP	.10470042 03	EPM	.14683203 03	EMP	.14203434 02	MEP	.18964535 02
MPS	.13793101 03	MSP	.57674939-01	SMP	.42011374 02	SEM	.12366484 03	EMS	.56214681 02	ESM	.12053439 00
RPM	.22824701 06	SPN	.73115676 02								
GCE	.10155817 03	GCT	.28171135 03	SIP	.13749547 03	CPT	.92066024 02	SIN	.91630490 02	D1	.22804901 00
REP	.17232891 06	VEP	.17300933 01	CPE	.97518579 02	CPS	.76880056 02	D2	.17030467 00	D3	.19245283-02

0 DAYS 1 HRS. 32 MIN. 2.000 SEC. 2356665111202020000000000 J.D.= 2438606.00000000 JULY 29,1964 12 00 00.000
TFL 0 DAYS 19 HRS. 9 MIN. 52.127 SEC.

GEOCENTRIC EQUATORIAL COORDINATES

X	.16440562 06	Y	.68334626 05	Z	.96198208 04	DX	.13671075 01	DY	.94484521 00	DZ	.27737203 00
R	.17830135 06	DEC	.30927574 01	RA	.22570045 02	V	.16848296 01	PTH	.76407958 02	AZ	.61440191 02
R	.17830134 06	LAT	.30927574 01	LON	.25540498 03	VE	.12742325 02	PTE	.73840781 01	AZE	.27085830 03
XS	-.90079426 08	YS	.11218494 09	ZS	.48648245 08	DXS	-.23497419 02	DYS	-.16101221 02	DZS	-.69821934 01
XM	.38196168 06	YM	.32601234 05	ZM	-.23746674 05	DXM	-.98456609-01	DYM	.93101695 00	DZM	.41079462 00
XT	.38196168 06	YT	.32601234 05	ZT	-.23746674 05	DXT	-.98456609-01	DYT	.93101695 00	DZT	.41079462 00
RS	.15187631 09	VS	.29327957 02	RM	.38408524 06	VM	.10223690 01	RT	.38408524 06	VT	.10223690 01
GED	.31137925 01	ALT	.17192320 06	LOS	.15978260 01	RAS	.12876289 03	RAM	.48784894 01	LOM	.23771343 03
DUT	.35000000 02	DT	.48000000 03	DR	.16376437 01	SHA	.17279896 06	DES	.18681968 02	DEM	-.35446624 01

HELIOCENTRIC EQUATORIAL COORDINATES

X	.90243831 08	Y	-.11211660 09	Z	-.48638625 08	DX	.24864527 02	DY	.17046066 02	DZ	.72595654 01
R	.15192036 09	LAT	-.18672521 02	LON	.30883095 03	V	.31008295 02	PTH	-.24778048 00	AZ	.75778842 02
XE	.90079426 08	YE	-.11218494 09	ZE	-.48648245 08	DXE	.23497419 02	DYE	.16101221 02	DZE	.69821934 01
XT	.90461387 08	YT	-.11215234 09	ZT	-.48671991 08	DXT	.23398963 02	DYT	.17032238 02	DZT	.73929880 01
LTE	-.18681968 02	LOE	.30876289 03	LTT	-.18664610 02	LOT	.30888943 03	RST	.15208672 09	VST	.29870803 02
EPS	.75663674 02	ESP	.64860743-01	SEP	.10427115 03	EPM	.14611306 03	EMP	.15000678 02	MEP	.18886258 02
MPS	.13822273 03	MSP	.54625775-01	SMP	.41721301 02	SEM	.12315717 03	EMS	.56721691 02	ESM	.12073714 00
RPM	.22298170 06	SPN	.73613715 02								
GCE	.10149755 03	GCT	.28172658 03	SIP	.13777691 03	CPT	.92140429 02	SIN	.91694611 02	D1	.23343430 00
REP	.17830135 06	VEP	.16848296 01	CPE	.97578967 02	CPS	.76884183 02	D2	.17513483 00	D3	.20371412-02

0 DAYS 2 HRS. 32 MIN. 2.000 SEC. 2356665127242020000000000 J.D.= 2438606.04166666 JULY 29,1964 13 00 00.000
TFL 0 DAYS 20 HRS. 9 MIN. 52.127 SEC.

GEOCENTRIC — EQUATORIAL COORDINATES

X	.16925436 06	Y	.71705259 C5	Z	.10613874 05	DX	.13270946 01	DY	.92786752 00	DZ	.27487869 00
R	.18412316 06	DEC	.33046760 01	RA	.22960133 02	V	.16424605 01	PTH	.76506319 02	AZ	.61458153 02
R	.18412316 06	LAT	.33046769 01	LON	.24075400 03	VE	.13165986 02	PTE	.69675186 01	AZE	.27080284 03
XS	-.90163993 08	YS	.11212694 09	ZS	.48623100 08	DXS	-.23485247 02	DYS	-.16116528 02	DZS	-.69888195 01
XM	.38158961 06	YM	.35951212 05	ZM	-.22266784 05	DXM	-.10825144 00	DYM	.93006999 00	DZM	.41136063 00
XT	.38158961 06	YT	.35951212 05	ZT	-.22266784 05	DXT	-.10825144 00	DYT	.93006999 00	DZT	.41136063 00
RS	.15187562 09	VS	.29328192 02	RM	.38392568 06	VM	.10227248 01	RT	.38392568 06	VT	.10227248 01
GED	.33271471 01	ALT	.17774503 06	LOS	.34659748 03	RAS	.12880360 03	RAM	.53821950 01	LOM	.22317607 03
DUT	.35000000 02	DT	.99999999 03	DR	.15971215 01	SHA	.17875290 06	DES	.18672043 02	DEM	-.33248857 01

HELIOCENTRIC — EQUATORIAL COORDINATES

X	.90333247 08	Y	-.11205524 09	Z	-.48612485 08	DX	.24812341 02	DY	.17044395 02	DZ	.72636981 01
R	.15191986 09	LAT	-.18662179 02	LON	.30887400 03	V	.30966514 02	PTH	-.26356846 00	AZ	.75757129 02
XE	.90163993 08	YE	-.11212694 09	ZE	-.48623100 08	DXE	.23485247 02	DYE	.16116528 02	DZE	.69888195 01
XT	.90545582 08	YT	-.11209099 09	ZT	-.48645366 08	DXT	.23376995 02	DYT	.17046598 02	DZT	.74001801 01
LTE	-.18672043 02	LOE	.30880360 03	LTT	-.18654485 02	LOT	.30893081 03	RST	.15208308 09	VST	.29863574 02
EPS	.76060475 02	ESP	.67448792-01	SEP	.10387211 03	EPM	.14543370 03	EMP	.15788934 02	MEP	.18777367 02
MPS	.13850493 03	MSP	.53265584-01	SMP	.41440695 02	SEM	.12264908 03	EMS	.57229136 02	ESM	.12154476 00
RPM	.21782044 06	SPN	.74075360 02								
GCE	.10144167 03	GCT	.28174169 03	SIP	.13804855 03	CPT	.92212095 02	SIN	.91755713 02	D1	.23896587 00
REP	.18412316 06	VEP	.16424605 01	CPE	.97634970 02	CPS	.76888305 02	D2	.18008233 00	D3	.21559962-02

0 DAYS 3 HRS. 32 MIN. 2.000 SEC. 23566651453020200000000 J.D.= 2438606.08333333 JULY 29,1964 14 00 00.000
TFL 0 DAYS 21 HRS. 9 MIN. 52.127 SEC.

GEOCENTRIC — EQUATORIAL COORDINATES

X	.17396378 06	Y	.75016198 05	Z	.11598946 05	DX	.12896489 01	DY	.91166118 00	DZ	.27238246 00
R	.18980348 06	DEC	.35035438 01	RA	.23326544 02	V	.16026580 01	PTH	.76593611 02	AZ	.61475722 02
R	.18980347 06	LAT	.35035438 01	LON	.22607935 03	VE	.13579293 02	PTE	.65924421 01	AZE	.27075370 03
XS	-.90248523 08	YS	.11206890 09	ZS	.48597527 08	DXS	-.23473063 02	DYS	-.16131829 02	DZS	-.69954430 01
XM	.38118227 06	YM	.39297640 05	ZM	-.20784918 05	DXM	-.11804914 00	DYM	.92903642 00	DZM	.41188951 00
XT	.38118227 06	YT	.39297640 05	ZT	-.20784918 05	DXT	-.11804914 00	DYT	.92903642 00	DZT	.41188951 00
RS	.15187492 09	VS	.29328429 02	RM	.38376587 06	VM	.10230822 01	RT	.38376587 06	VT	.10230822 01
GED	.35273596 01	ALT	.18342535 06	LOS	.33159713 03	RAS	.12884432 03	RAM	.58860606 01	LOM	.20863887 03
DUT	.35000000 02	DT	.19200000 04	DR	.15589856 01	SHA	.18455932 06	DES	.18662108 02	DEM	-.31046812 01

HELIOCENTRIC — EQUATORIAL COORDINATES

X	.90422486 08	Y	-.11199388 09	Z	-.48586328 08	DX	.24762711 02	DY	.17043490 02	DZ	.72678255 01
R	.15191934 09	LAT	-.18651833 02	LON	.30891698 03	V	.30927232 02	PTH	-.27776586 00	AZ	.75735979 02
XE	.90248523 08	YE	-.11206890 09	ZE	-.48597927 08	DXE	.23473063 02	DYE	.16131829 02	DZE	.69954430 01
XT	.90629705 08	YT	-.11202960 09	ZT	-.48618711 08	DXT	.23355014 02	DYT	.17060865 02	DZT	.74073325 01
LTE	-.18662108 02	LOE	.30884432 03	LTT	-.18644352 02	LOT	.30897216 03	RST	.15207943 09	VST	.29856294 02
EPS	.76430557 02	ESP	.69590554-01	SEP	.10349983 03	EPM	.14479018 03	EMP	.16568528 02	MEP	.18641284 02
MPS	.13877795 03	MSP	.51869734-01	SMP	.41169223 02	SEM	.12214056 03	EMS	.57737013 02	ESM	.12234704 00
RPM	.21275346 06	SPN	.74504874 02								
GCE	.10138996 03	GCT	.28175661 03	SIP	.13831C70 03	CPT	.92281166 02	SIN	.91813916 02	D1	.24465751 00
REP	.18980348 06	VEP	.16026580 01	CPE	.97687113 02	CPS	.76892424 02	D2	.18515836 00	D3	.22816197-02

0 DAYS 4 HRS. 32 MIN. 2.000 SEC. 23566651633420200000000 J.D.= 2438606.12500000 JULY 29,1964 15 00 00.000
TFL 0 DAYS 22 HRS. 9 MIN. 52.127 SEC.

GEOCENTRIC — EQUATORIAL COORDINATES

X	.17854258 06	Y	.78270077 05	Z	.12575041 05	DX	.12544879 01	DY	.89615725 00	DZ	.26989228 00
R	.19535042 06	DEC	.36907789 01	RA	.23671842 02	V	.15651452 01	PTH	.76671132 02	AZ	.61492798 02
R	.19535042 06	LAT	.36907789 01	LON	.21138358 03	VE	.13982807 02	PTE	.62529698 01	AZE	.27070989 03
XS	-.90333006 08	YS	.11201C79 09	ZS	.48572730 08	DXS	-.23460866 02	DYS	-.16147123 02	DZS	-.70020634 01
XM	.38073965 06	YM	.42640190 05	ZM	-.19301216 05	DXM	-.12784878 00	DYM	.92791609 00	DZM	.41238116 00
XT	.38073965 06	YT	.42640190 05	ZT	-.19301216 05	DXT	-.12784878 00	DYT	.92791609 00	DZT	.41238116 00
RS	.15187422 09	VS	.29328667 02	RM	.38360579 06	VM	.10234412 01	RT	.38360579 06	VT	.10234412 01
GED	.37158605 01	ALT	.18897231 06	LOS	.31659677 03	RAS	.12888503 03	RAM	.63901008 01	LOM	.19410184 03
DUT	.35000000 02	DT	.19200000 04	DR	.15229847 01	SHA	.19022679 06	DES	.18652164 02	DEM	-.28840670 01

HELIOCENTRIC — EQUATORIAL COORDINATES

X	.90511548 08	Y	-.11193252 09	Z	-.48560154 08	DX	.24715354 02	DY	.17043280 02	DZ	.72719557 01
R	.15191879 09	LAT	-.18641486 02	LON	.30895991 03	V	.30890184 02	PTH	-.29057930 00	AZ	.75715329 02
XE	.90333006 08	YE	-.11201C79 09	ZE	-.48572730 08	DXE	.23460866 02	DYE	.16147123 02	DZE	.70020634 01
XT	.90713745 08	YT	-.11196815 09	ZT	-.48592C31 08	DXT	.23333018 02	DYT	.17075039 02	DZT	.74144445 01
LTE	-.18652164 02	LOE	.30888503 03	LTT	-.18634211 02	LOT	.30901351 03	RST	.15207575 09	VST	.29848964 02
EPS	.76776812 02	ESP	.71668340-C1	SEP	.10315144 03	EPM	.14417933 03	EMP	.17339764 02	MEP	.18480903 02
MPS	.13904210 03	MSP	.51396029-01	SMP	.40906584 02	SEM	.12163162 03	EMS	.58245324 02	ESM	.12294532 00
RPM	.20777209 06	SPN	.74905830 02								
GCE	.10134194 03	GCT	.28177130 03	SIP	.13856364 03	CPT	.92347770 02	SIN	.91869315 02	D1	.25052361 00
REP	.19535042 06	VEP	.15651452 01	CPE	.97735836 02	CPS	.76896539 02	D2	.19037468 00	D3	.24145902-02

0 DAYS 5 HRS. 32 MIN. 2.000 SEC. 23566652C1402020000000000 J.D.= 2438606.16666666 JULY 29,1964 16 00 00.000
TFL 0 DAYS 23 HRS. 9 MIN. 52.127 SEC.

GEOCENTRIC — EQUATORIAL COORDINATES

X	.18299854 06	Y	.81469301 05	Z	.13542187 05	DX	.12213724 01	DY	.88129509 00	DZ	.26741466 00
R	.20077127 06	DEC	.38675835 01	RA	.23998198 02	V	.15296870 01	PTH	.76740012 02	AZ	.61509280 02
R	.20077127 06	LAT	.38675835 01	LON	.19666887 03	VE	.14377040 02	PTE	.59442820 01	AZE	.27067062 03
XS	-.90417441 08	YS	.11195263 09	ZS	.48547513 08	DXS	-.23448660 02	DYS	-.16162410 02	DZS	-.70086808 01
XM	.38026176 06	YM	.45978535 05	ZM	-.17815817 05	DXM	-.13764942 00	DYM	.92670888 00	DZM	.41283545 00
XT	.38026176 06	YT	.45978535 05	ZT	-.17815817 05	DXT	-.13764942 00	DYT	.92670888 00	DZT	.41283545 00
RS	.15187352 09	VS	.29328906 02	RM	.38344547 06	VM	.10238016 01	RT	.38344547 06	VT	.10238016 01
GED	.38938594 01	ALT	.19439316 06	LOS	.30159641 03	RAS	.12892573 03	RAM	.68943288 01	LOM	.17956501 03
DUT	.35000000 02	DT	.19200000 04	DR	.14889C45 01	SHA	.19576296 06	DES	.18642213 02	DEM	-.26630600 01

HELIOCENTRIC — EQUATORIAL COORDINATES

X	.90600439 08	Y	-.11187117 09	Z	-.48533970 08	DX	.24670032 02	DY	.17043705 02	DZ	.72760954 01
R	.15191821 09	LAT	-.18631137 02	LON	.30900277 03	V	.30855144 02	PTH	-.30217440 00	AZ	.75695131 02
XE	.90417441 08	YE	-.11195263 09	ZE	-.48547513 08	DXE	.23448660 02	DYE	.16162410 02	DZE	.70086808 01
XT	.90797702 08	YT	-.11190666 09	ZT	-.48565328 08	DXT	.23311010 02	DYT	.17089119 02	DZT	.74215162 01
LTE	-.18642213 02	LOE	.30892573 03	LTT	-.18624062 02	LOT	.30905484 03	RST	.15207206 09	VST	.29841583 02
EPS	.77101701 02	ESP	.73354886-01	SEP	.10282446 03	EPM	.14359841 03	EMP	.18102903 02	MEP	.18298683 02
MPS	.13929765 03	MSP	.49455853-01	SMP	.40652503 02	SEM	.12112225 03	EMS	.58754074 02	ESM	.12354070 00
RPM	.20286866 06	SPN	.75281253 02								
GCE	.10129722 03	GCT	.28178568 03	SIP	.13880763 03	CPT	.92412023 02	SIN	.91922005 02	D1	.25657932 00
REP	.20077127 06	VEP	.15296870 01	CPE	.97781510 02	CPS	.76900651 02	D2	.19574371 00	D3	.25555441-02

0 DAYS 6 HRS. 32 MIN. 2.000 SEC. 23566652174420200000000 J.D.= 2438606.20833333 JULY 29,1964 17 00 00.000
TFL 1 DAYS 0 HRS. 9 MIN. 52.127 SEC.

GEOCENTRIC — EQUATORIAL COORDINATES

X	.18733866 06	Y	.84616106 05	Z	.14500448 05	DX	.11900975 01	DY	.86702129 00	DZ	.26495428 00
R	.20607261 06	DEC	.40349931 01	RA	.24307483 02	V	.14960811 01	PTH	.76801215 02	AZ	.61525100 02
R	.20607261 06	LAT	.40349931 01	LON	.18193709 03	VE	.14762463 02	PTE	.56623864 01	AZE	.27063522 03
XS	-.90501837 08	YS	.11189442 09	ZS	.48522269 08	DXS	-.23436440 02	DYS	-.16177691 02	DZS	-.70152955 01
XM	.37974858 06	YM	.49312390 05	ZM	-.16328845 05	DXM	-.14745025 00	DYM	.92541473 00	DZM	.41325220 00
XT	.37974858 06	YT	.49312390 05	ZT	-.16328845 05	DXT	-.14745025 00	DYT	.92541473 00	DZT	.41325220 00
RS	.15187282 09	VS	.29329145 02	RM	.38328491 06	VM	.10241637 01	RT	.38328491 06	VT	.10241637 01
GED	.40623989 01	ALT	.19969451 06	LOS	.28659604 03	RAS	.12896644 03	RAM	.73987634 01	LOM	.16502837 03
DUT	.35000000 02	DT	.19200000 04	DR	.14565603 01	SHA	.20117479 06	DES	.18632251 02	DEM	-.24416739 01

HELIOCENTRIC — EQUATORIAL COORDINATES

X	.90689175 08	Y	-.11180981 09	Z	-.48507769 08	DX	.24626538 02	DY	.17044712 02	DZ	.72802497 01
R	.15191762 09	LAT	-.18620784 02	LON	.30904558 03	V	.30821917 02	PTH	-.31269374 00	AZ	.75675335 02
XE	.90501837 08	YE	-.11189442 09	ZE	-.48522269 08	DXE	.23436440 02	DYE	.16177691 02	DZE	.70152955 01
XT	.90881585 08	YT	-.11184511 09	ZT	-.48538598 08	DXT	.23288990 02	DYT	.17103105 02	DZT	.74285477 01
LTE	-.18632251 02	LOE	.30896644 03	LTT	-.18613905 02	LOT	.30909615 03	RST	.15206836 09	VST	.29834151 02
EPS	.77407333 02	ESP	.75975525-01	SEP	.10251679 03	EPM	.14304508 03	EMP	.18858195 02	MEP	.18096720 02
MPS	.13954486 03	MSP	.47949227-01	SMP	.40406722 02	SEM	.12061245 03	EMS	.59263260 02	ESM	.12433010 00
RPM	.19803629 06	SPN	.75633731 02								
GCE	.10125546 03	GCT	.28179970 03	SIP	.13904288 03	CPT	.92474035 02	SIN	.91972059 02	D1	.26284071 00
REP	.20607261 06	VEP	.14960811 01	CPE	.97824449 02	CPS	.76904761 02	D2	.20127865 00	D3	.27051861-02

0 DAYS 7 HRS. 32 MIN. 2.000 SEC. 2356665235502020000000C00 J.D.= 2438606.25000000 JULY 29,1964 18 00 00.000
TFL 1 DAYS 1 HRS. 9 MIN. 52.127 SEC.

GEOCENTRIC — EQUATORIAL COORDINATES

X	.19156924 06	Y	.87712503 05	Z	.15449885 05	DX	.11604872 01	DY	.85328837 00	DZ	.26251443 00
R	.21126040 06	DEC	.41938958 01	RA	.24601301 02	V	.14641535 01	PTH	.76855589 02	AZ	.61540185 02
R	.21126040 06	LAT	.41938958 01	LON	.16718985 03	VE	.15139502 02	PTE	.54039525 01	AZE	.27060317 03
XS	-.90586184 08	YS	.11183616 09	ZS	.48497006 08	DXS	-.23424210 02	DYS	-.16192964 02	DZS	-.70219070 01
XM	.37920C11 06	YM	.52641415 05	ZM	-.14840446 05	DXM	-.15725028 00	DYM	.92403351 00	DZM	.41363133 00
XT	.37920011 06	YT	.52641415 05	ZT	-.14840446 05	DXT	-.15725028 00	DYT	.92403351 00	DZT	.41363133 00
RS	.15187212 09	VS	.29329386 02	RM	.38312410 06	VM	.10245274 01	RT	.38312410 06	VT	.10245274 01
GED	.42223732 01	ALT	.20488231 06	LOS	.27159568 03	RAS	.12900713 03	RAM	.79034184 01	LOM	.15049197 03
DUT	.35000000 02	DT	.19200000 04	DR	.14257927 01	SHA	.20646852 06	DES	.18622282 02	DEM	-.22199267 01

HELIOCENTRIC — EQUATORIAL COORDINATES

X	.90777753 08	Y	-.11174844 09	Z	-.48481556 08	DX	.24584697 02	DY	.17046252 02	DZ	.72844215 01
R	.15191700 09	LAT	-.18610430 02	LON	.30908834 03	V	.30790336 02	PTH	-.32225771 00	AZ	.75655905 02
XE	.90586184 08	YE	-.11183616 09	ZE	-.48497006 08	DXE	.23424210 02	DYE	.16192964 02	DZE	.70219070 01
XT	.90965384 08	YT	-.11178351 09	ZT	-.48511846 08	DXT	.23266960 02	DYT	.17116997 02	DZT	.74355384 01
LTE	-.18622282 02	LOE	.30900713 03	LTT	-.18603742 02	LOT	.30913745 03	RST	.15206464 09	VST	.29826670 02
EPS	.77695525 02	ESP	.77252514-01	SEP	.10222660 03	EPM	.14251728 03	EMP	.19605879 02	MEP	.17876836 02
MPS	.13978396 03	MSP	.45863470-01	SMP	.40169016 02	SEM	.12010223 03	EMS	.59772886 02	ESM	.12433010 00
RPM	.19326880 06	SPN	.75965490 02								
GCE	.10121634 03	GCT	.28181329 03	SIP	.13926960 03	CPT	.92533906 02	SIN	.92019546 02	D1	.26932489 00
REP	.21126040 06	VEP	.14641535 01	CPE	.97864923 02	CPS	.76908872 02	D2	.20699359 00	D3	.28642952-02

0 DAYS 8 HRS. 32 MIN. 2.000 SEC. 235666525354202000000000 J.D.= 2438606.29166666 JULY 29,1964 19 00 00.000
TFL 1 DAYS 2 HRS. 9 MIN. 52.127 SEC.

GEOCENTRIC — EQUATORIAL COORDINATES

X	.19569598 06	Y	.90760379 05	Z	.16390580 05	DX	.11323896 01	DY	.84005421 00	DZ	.26009737 00
R	.21634004 06	DEC	.43450666 01	RA	.24881048 02	V	.14337531 01	PTH	.76903872 02	AZ	.61554475 02
R	.21634004 06	LAT	.43450666 01	LON	.15242853 03	VE	.15508551 02	PTE	.51661792 01	AZE	.27057403 03
XS	-.90670492 08	YS	.11177783 09	ZS	.48471713 08	DXS	-.23411967 02	DYS	-.16208232 02	DZS	-.70285160 01
XM	.37861638 06	YM	.55965329 05	ZM	-.13350743 05	DXM	-.16704869 00	DYM	.92256514 00	DZM	.41397267 00
XT	.37861638 06	YT	.55965329 05	ZT	-.13350743 05	DXT	-.16704869 00	DYT	.92256514 00	DZT	.41397267 00
RS	.15187142 09	VS	.29329627 02	RM	.38296308 06	VM	.10248927 01	RT	.38296308 06	VT	.10248927 01
GED	.43745627 01	ALT	.20996196 06	LOS	.25659530 03	RAS	.12904782 03	RAM	.84083144 01	LOM	.13595579 03
DUT	.35000000 02	DT	.19200000 04	DR	.13964630 01	SHA	.21164985 06	DES	.18612304 02	DEM	-.19978320 01

HELIOCENTRIC — EQUATORIAL COORDINATES

X	.90866187 08	Y	-.11168707 09	Z	-.48455322 08	DX	.24544357 02	DY	.17048286 02	DZ	.72886133 01
R	.15191637 09	LAT	-.18600071 02	LON	.30913106 03	V	.30760256 02	PTH	-.33096620 00	AZ	.75636808 02
XE	.90670492 08	YE	-.11177783 09	ZE	-.48471713 08	DXE	.23411967 02	DYE	.16208232 02	DZE	.70285160 01
XT	.91049108 08	YT	-.11172187 09	ZT	-.48485063 08	DXT	.23244919 02	DYT	.17130797 02	DZT	.74424887 01
LTE	-.18612304 02	LOE	.30904783 03	LTT	-.18593568 02	LOT	.30917874 03	RST	.15206090 09	VST	.29819139 02
EPS	.77967853 02	ESP	.79437864-01	SEP	.10195232 03	EPM	.14201324 03	EMP	.20346152 02	MEP	.17640604 02
MPS	.14001517 03	MSP	.45863470-01	SMP	.39939172 02	SEM	.11959157 03	EMS	.60282952 02	ESM	.12511453 00
RPM	.18856064 06	SPN	.76278452 02								
GCE	.10117964 03	GCT	.28182642 03	SIP	.13948797 03	CPT	.92591731 02	SIN	.92064528 02	D1	.27605021 00
REP	.21634004 06	VEP	.14337531 01	CPE	.97903167 02	CPS	.76912979 02	D2	.21290365 00	D3	.30337369-02

0 DAYS 9 HRS. 32 MIN. 2.000 SEC. 235666527160202000000000 J.D.= 2438606.33333333 JULY 29,1964 20 00 00.000
TFL 1 DAYS 3 HRS. 9 MIN. 52.127 SEC.

GEOCENTRIC — EQUATORIAL COORDINATES

X	.19972410 06	Y	.93761457 05	Z	.17322619 05	DX	.11056720 01	DY	.82728092 00	DZ	.25770453 00
R	.22131651 06	DEC	.44891776 01	RA	.25147938 02	V	.14047476 01	PTH	.76946738 02	AZ	.61567913 02
R	.22131651 06	LAT	.44891776 01	LON	.13765435 03	VE	.15869972 02	PTE	.49466927 01	AZE	.27054742 03
XS	-.90754758 08	YS	.11171945 09	ZS	.48446398 08	DXS	-.23399713 02	DYS	-.16223493 02	DZS	-.70351222 01
XM	.37799736 06	YM	.59283800 05	ZM	-.11859879 05	DXM	-.17684453 00	DYM	.92100954 00	DZM	.41427610 00
XT	.37799736 06	YT	.59283800 05	ZT	-.11859879 05	DXT	-.17684453 00	DYT	.92100954 00	DZT	.41427610 00
RS	.15187072 09	VS	.29329869 02	RM	.38280182 06	VM	.10252596 01	RT	.38280182 06	VT	.10252596 01
GED	.45196441 01	ALT	.21493844 06	LOS	.24159493 03	RAS	.12908852 03	RAM	.89134642 01	LOM	.12141988 03
DUT	.35000000 02	DT	.19200000 04	DR	.13684497 01	SHA	.21672399 06	DES	.18602315 02	DEM	-.17754086 01

HELIOCENTRIC — EQUATORIAL COORDINATES

X	.90954482 08	Y	-.11162569 09	Z	-.48429075 08	DX	.24505385 02	DY	.17050773 02	DZ	.72928267 01
R	.15191572 09	LAT	-.18589708 02	LON	.30917372 03	V	.30731548 02	PTH	-.33890459 00	AZ	.75618016 02
XE	.90754758 08	YE	-.11171945 09	ZE	-.48446398 08	DXE	.23399713 02	DYE	.16223493 02	DZE	.70351222 01
XT	.91132755 08	YT	-.11166017 09	ZT	-.48458258 08	DXT	.23222868 02	DYT	.17144502 02	DZT	.74493983 01
LTE	-.18602315 02	LOE	.30908851 03	LTT	-.18583388 02	LOT	.30922001 03	RST	.15205714 09	VST	.29811560 02
EPS	.78225692 02	ESP	.81564685-01	SEP	.10169257 03	EPM	.14153138 03	EMP	.21079216 02	MEP	.17389400 02
MPS	.14023869 03	MSP	.43678226-01	SMP	.39716985 02	SEM	.11908048 03	EMS	.60793459 02	ESM	.12569964 00
RPM	.18390673 06	SPN	.76574288 02								
GCE	.10114512 03	GCT	.28183902 03	SIP	.13969814 03	CPT	.92647602 02	SIN	.92107058 02	D1	.28303649 00
REP	.22131651 06	VEP	.14047476 01	CPE	.97939381 02	CPS	.76917087 02	D2	.21902522 00	D3	.32144788-02

0 DAYS 10 HRS. 32 MIN. 2.000 SEC. 235666530764202000000000 J.D.= 2438606.37500000 JULY 29,1964 21 00 00.000
TFL 1 DAYS 4 HRS. 9 MIN. 52.127 SEC.

GEOCENTRIC EQUATORIAL COORDINATES

X	.20365834 06	Y	.96717321 05	Z	.18246086 05	DX	.10802188 01	DY	.81493457 00	DZ	.25533671 00
R	.22619434 06	DEC	.46268213 01	RA	.2540 3037 02	V	.13770214 01	PTH	.76984775 02	AZ	.61580438 02
R	.22619434 06	LAT	.46268213 01	LON	.12286839 03	VE	.16224097 02	PTE	.47434707 01	AZE	.27052302 03
XS	-.90838971 08	YS	.11166102 09	ZS	.48421061 08	DXS	-.23387447 02	DYS	-.16238746 02	DZS	-.70417250 01
XM	.37734310 06	YM	.62596498 05	ZM	-.10367998 05	DXM	-.18663683 00	DYM	.91936664 00	DZM	.41454153 00
XT	.37734310 06	YT	.62596498 05	ZT	-.10367998 05	DXT	-.18663683 00	DYT	.91936664 00	DZT	.41454153 00
RS	.15187001 09	VS	.29330111 02	RM	.38264034 06	VM	.10256281 01	RT	.38264034 06	VT	.10256281 01
GED	.46582138 01	ALT	.21981627 06	LOS	.22659455 03	RAS	.12912920 03	RAM	.94188815 01	LOM	.10688423 03
DUT	.35000000 02	DT	.19200000 04	DR	.13416461 01	SHA	.22169572 06	DES	.18592319 02	DEM	-.15526710 01

HELIOCENTRIC EQUATORIAL COORDINATES

X	.91042629 08	Y	-.11156430 09	Z	-.48402815 08	DX	.24467666 02	DY	.17053680 02	DZ	.72970617 01
R	.15191506 09	LAT	-.18579344 02	LON	.30921635 03	V	.30704100 02	PTH	-.34615057 00	AZ	.75599504 02
XE	.90838971 08	YE	-.11166102 09	ZE	-.48421061 08	DXE	.23387447 02	DYE	.16238746 02	DZE	.70417250 01
XT	.91216314 08	YT	-.11159842 09	ZT	-.48431429 08	DXT	.23200810 02	DYT	.17158113 02	DZT	.74562665 01
LTE	-.18592319 02	LOE	.30912920 03	LTT	-.18573201 02	LOT	.30926126 03	RST	.15205337 09	VST	.29803931 02
EPS	.78470249 02	ESP	.83637439-01	SEP	.10144613 03	EPM	.14107032 03	EMP	.21805245 02	MEP	.17124428 02
MPS	.14045469 03	MSP	.41964682-01	SMP	.39502286 02	SEM	.11856896 03	EMS	.61304411 02	ESM	.12647557 00
RPM	.17930251 06	SPN	.76854466 02								
GCE	.10111259 03	GCT	.28185103 03	SIP	.13990027 03	CPT	.92701600 02	SIN	.92147175 02	D1	.29030512 00
REP	.22619434 06	VEP	.13770214 01	CPE	.97973742 02	CPS	.76921193 02	D2	.22537595 00	D3	.34075980-02

0 DAYS 11 HRS. 32 MIN. 2.000 SEC. 2356665325702020000000C00 J.D.= 2438606.41666666 JULY 29,1964 22 00 00.000
TFL 1 DAYS 5 HRS. 9 MIN. 52.127 SEC.

GEOCENTRIC EQUATORIAL COORDINATES

X	.20750307 06	Y	.99629466 05	Z	.19161C77 05	DX	.10559284 01	DY	.80298459 00	DZ	.25299427 00
R	.23097771 06	DEC	.47585193 01	RA	.25647287 02	V	.13504722 01	PTH	.77018547 02	AZ	.61591992 02
R	.23097770 06	LAT	.47585193 01	LON	.10807157 03	VE	.16571235 02	PTE	.45547790 01	AZE	.27050059 03
XS	-.90923149 08	YS	.11160253 09	ZS	.48395699 08	DXS	-.23375169 02	DYS	-.16253994 02	DZS	-.70483252 01
XM	.37665359 06	YM	.65903141 05	ZM	-.88752233 04	DXM	-.19642476 00	DYM	.91763636 00	DZM	.41476879 00
XT	.37665359 06	YT	.65903141 05	ZT	-.88752233 04	DXT	-.19642476 00	DYT	.91763636 00	DZT	.41476879 00
RS	.15186931 09	VS	.29330355 02	RM	.38247865 06	VM	.10259982 01	RT	.38247865 06	VT	.10259982 01
GED	.47907971 01	ALT	.22459965 06	LOS	.21159416 03	RAS	.12916988 03	RAM	.99245879 01	LOM	.92348877 02
DUT	.35000000 02	DT	.19200000 04	DR	.13159580 01	SHA	.22656940 06	DES	.18582313 02	DEM	-.13296380 01

HELIOCENTRIC EQUATORIAL COORDINATES

X	.91130652 08	Y	-.11150290 09	Z	-.48376537 08	DX	.24431097 02	DY	.17056978 02	DZ	.73013195 01
R	.15191439 09	LAT	-.18568973 02	LON	.30925892 03	V	.30677814 02	PTH	-.35276475 00	AZ	.75581247 02
XE	.90923149 08	YE	-.11160253 09	ZE	-.48395699 08	DXE	.23375169 02	DYE	.16253994 02	DZE	.70483252 01
XT	.91299802 08	YT	-.11153663 09	ZT	-.48404574 08	DXT	.23178744 02	DYT	.17171630 02	DZT	.74630940 01
LTE	-.18582313 02	LOE	.30916988 03	LTT	-.18563005 02	LOT	.30930250 03	RST	.15204958 09	VST	.29796255 02
EPS	.78702585 02	ESP	.85374C42-01	SEP	.10121196 03	EPM	.14062885 03	EMP	.22524396 02	MEP	.16846750 02
MPS	.14066335 03	MSP	.41377734-01	SMP	.39294909 02	SEM	.11805700 03	EMS	.61815809 02	ESM	.12705441 00
RPM	.17474381 06	SPN	.77120274 02								
GCE	.10108189 03	GCT	.28186240 03	SIP	.14009446 03	CPT	.92753807 02	SIN	.92184917 02	D1	.29787932 00
REP	.23097771 06	VEP	.13504722 01	CPE	.98006406 02	CPS	.76925299 02	D2	.23197506 00	D3	.36143027-02

0 DAYS 12 HRS. 32 MIN. 2.000 SEC. 2356665343742020000000C00 J.D.= 2438606.45833333 JULY 29,1964 23 00 00.000
TFL 1 DAYS 6 HRS. 9 MIN. 52.127 SEC.

GEOCENTRIC EQUATORIAL COORDINATES

X	.21126231 06	Y	.10249926 06	Z	.20067680 05	DX	.10327113 01	DY	.79140329 00	DZ	.25067715 00
R	.23567048 06	DEC	.48847336 01	RA	.25881517 02	V	.13250097 01	PTH	.77048539 02	AZ	.61602513 02
R	.23567047 06	LAT	.48847336 01	LON	.93264741 02	VE	.16911673 02	PTE	.43791194 01	AZE	.27047990 03
XS	-.91007280 08	YS	.11154399 09	ZS	.48370311 08	DXS	-.23362880 02	DYS	-.16269235 02	DZS	-.70549224 01
XM	.37592885 06	YM	.69203393 05	ZM	-.73816995 04	DXM	-.20620736 00	DYM	.91581865 00	DZM	.41495780 00
XT	.37592885 06	YT	.69203393 05	ZT	-.73816995 04	DXT	-.20620736 00	DYT	.91581865 00	DZT	.41495780 00
RS	.15186860 09	VS	.29330600 02	RM	.38231675 06	VM	.10263699 01	RT	.38231675 06	VT	.10263699 01
GED	.49178592 01	ALT	.22929242 06	LOS	.19659378 03	RAS	.12921056 03	RAM	.10430599 02	LOM	.77813820 02
DUT	.35000000 02	DT	.19200000 04	DR	.12913019 01	SHA	.23134909 06	DES	.18572298 02	DEM	-.11063242 01

HELIOCENTRIC EQUATORIAL COORDINATES

X	.91218542 08	Y	-.11144149 09	Z	-.48350244 08	DX	.24395591 02	DY	.17060638 02	DZ	.73055995 01
R	.15191370 09	LAT	-.18558599 02	LON	.30930146 03	V	.30652602 02	PTH	-.35880008 00	AZ	.75563228 02
XE	.91007280 08	YE	-.11154399 09	ZE	-.48370311 08	DXE	.23362880 02	DYE	.16269235 02	DZE	.70549224 01
XT	.91383208 08	YT	-.11147478 09	ZT	-.48377693 08	DXT	.23156672 02	DYT	.17185053 02	DZT	.74698802 01
LTE	-.18572298 02	LOE	.30921055 03	LTT	-.18552801 02	LOT	.30934373 03	RST	.15204578 09	VST	.29788532 02
EPS	.78923641 02	ESP	.87076018-01	SEP	.10098910 03	EPM	.14020587 03	EMP	.23236824 02	MEP	.16557305 02
MPS	.14086480 03	MSP	.40178123-01	SMP	.39094706 02	SEM	.11754461 03	EMS	.62327652 02	ESM	.12763062 00
RPM	.17022677 06	SPN	.77372845 02								
GCE	.10105285 03	GCT	.28187306 03	SIP	.14028C81 03	CPT	.92804298 02	SIN	.92220312 02	D1	.30578448 00
REP	.23567048 06	VEP	.13250097 01	CPE	.98037504 02	CPS	.76929407 02	D2	.23884356 00	D3	.38359518-02

0 DAYS 13 HRS. 32 MIN. 2.000 SEC. 2356665362C020200000000C00 J.D.= 2438606.50000000 JULY 30,1964 00 00 00.000
TFL 1 DAYS 7 HRS. 9 MIN. 52.127 SEC.

GEOCENTRIC EQUATORIAL COORDINATES

X	.21493978 06	Y	.10532798 06	Z	.20965984 05	DX	.10104883 01	DY	.78016546 00	DZ	.24838499 00
R	.24027623 06	DEC	.50058720 01	RA	.26106463 02	V	.13005536 01	PTH	.77075231 02	AZ	.61611938 02
R	.24027622 06	LAT	.50058720 01	LON	.78448575 02	VE	.17245677 02	PTE	.42151940 01	AZE	.27046074 03
XS	-.91091362 08	YS	.11148539 09	ZS	.48344905 08	DXS	-.23350579 02	DYS	-.16284468 02	DZS	-.70615166 01
XM	.37516890 06	YM	.72496929 05	ZM	-.58875716 04	DXM	-.21598359 00	DYM	.91391341 00	DZM	.41510842 00
XT	.37516890 06	YT	.72496929 05	ZT	-.58875716 04	DXT	-.21598359 00	DYT	.91391341 00	DZT	.41510842 00
RS	.15186790 09	VS	.29330845 02	RM	.38215464 06	VM	.10267432 01	RT	.38215464 06	VT	.10267432 01
GED	.50398108 01	ALT	.23389819 06	LOS	.18159333 03	RAS	.12925122 03	RAM	.10936927 02	LOM	.63279037 02
DUT	.35000000 02	DT	.19200000 04	DR	.12676036 01	SHA	.23603854 06	DES	.18562277 02	DEM	-.88274730 00

HELIOCENTRIC EQUATORIAL COORDINATES

X	.91306301 08	Y	-.11138006 09	Z	-.48323939 08	DX	.24361068 02	DY	.17064634 02	DZ	.73099016 01
R	.15191301 09	LAT	-.18548222 02	LON	.30934395 03	V	.30628385 02	PTH	-.36430692 00	AZ	.75545431 02
XE	.91091362 08	YE	-.11148539 09	ZE	-.48344905 08	DXE	.23350579 02	DYE	.16284468 02	DZE	.70615166 01
XT	.91466530 08	YT	-.11141290 09	ZT	-.48350792 08	DXT	.23134596 02	DYT	.17198381 02	DZT	.74766251 01
LTE	-.18562277 02	LOE	.30925123 03	LTT	-.18542591 02	LOT	.30938493 03	RST	.15204196 09	VST	.29780762 02
EPS	.79134250 02	ESP	.88745359-01	SEP	.10077672 03	EPM	.13980041 03	EMP	.23942656 02	MEP	.16256929 02
MPS	.14105920 03	MSP	.38308338-01	SMP	.38901541 02	SEM	.11703178 03	EMS	.62839942 02	ESM	.12820425 00
RPM	.16574788 06	SPN	.77613188 02								
GCE	.10102536 03	GCT	.28188295 03	SIP	.14045943 03	CPT	.92853148 02	SIN	.92253381 02	D1	.31404836 00
REP	.24027623 06	VEP	.13005536 01	CPE	.98067159 02	CPS	.76933515 02	D2	.24600442 00	D3	.40740760-02

0 DAYS 14 HRS. 32 MIN. 2.000 SEC. 23566654C0C4202000000000 J.D.= 2438606.54166666 JULY 30,1964 01 00 00.000
TFL 1 DAYS 8 HRS. 9 MIN. 52.127 SEC.

GEOCENTRIC EQUATORIAL COORDINATES

X	.21853893 06	Y	.10811684 06	Z	.21856082 05	DX	.98918905 00	DY	.76924823 00	DZ	.24611723 00
R	.24479829 06	DEC	.51223028 01	RA	.26322787 02	V	.12770323 01	PTH	.77099073 02	AZ	.61620193 02
R	.24479828 06	LAT	.51223028 01	LON	.63623831 02	VE	.17573497 02	PTE	.40618776 01	AZE	.27044296 03
XS	-.91175403 08	YS	.11142674 09	ZS	.48319471 08	DXS	-.23338266 02	DYS	-.16299695 02	DZS	-.70681081 01
XM	.37437377 06	YM	.75783464 05	ZM	-.43929651 04	DXM	-.22575273 00	DYM	.91192069 00	DZM	.41522055 00
XT	.37437377 06	YT	.75783464 05	ZT	-.43929651 04	DXT	-.22575273 00	DYT	.91192069 00	DZT	.41522055 00
RS	.15186719 09	VS	.29331091 02	RM	.38199234 06	VM	.10271182 01	RT	.38199234 06	VT	.10271182 01
GED	.51570226 01	ALT	.23842025 06	LOS	.16659293 03	RAS	.12929189 03	RAM	.11443594 02	LOM	.48744636 02
DUT	.35000000 02	DT	.19200000 04	DR	.12447969 01	SHA	.24064124 06	DES	.18552244 02	DEM	-.65892371 00

HELIOCENTRIC EQUATORIAL COORDINATES

X	.91393941 08	Y	-.11131862 09	Z	-.48297614 08	DX	.24327455 02	DY	.17068943 02	DZ	.73142253 01
R	.15191230 09	LAT	-.18537839 02	LON	.30938641 03	V	.30605094 02	PTH	-.36932625 00	AZ	.75527837 02
XE	.91175403 08	YE	-.11142674 09	ZE	-.48319471 08	DXE	.23338266 02	DYE	.16299695 02	DZE	.70681081 01
XT	.91549776 08	YT	-.11135096 09	ZT	-.48323863 08	DXT	.23112513 02	DYT	.17211616 02	DZT	.74833286 01
LTE	-.18552244 02	LOE	.30929189 03	LTT	-.18532372 02	LOT	.30942613 03	RST	.15203813 09	VST	.29772944 02
EPS	.79335160 02	ESP	.90923484-01	SEP	.10057408 03	EPM	.13941161 03	EMP	.24642019 02	MEP	.15946370 02
MPS	.14124665 03	MSP	.38308338-01	SMP	.38715295 02	SEM	.11651850 03	EMS	.63352684 02	ESM	.12877532 00
RPM	.16130393 06	SPN	.77842202 02								
GCE	.10099930 03	GCT	.28189201 03	SIP	.14063036 03	CPT	.92900430 02	SIN	.92284139 02	D1	.32270145 00
REP	.24479829 06	VEP	.12770323 01	CPE	.98095475 02	CPS	.76937623 02	D2	.25348287 00	D3	.43304056-02

0 DAYS 15 HRS. 32 MIN. 2.000 SEC. 2356665416102020000000000 J.D.= 2438606.58333334 JULY 30,1964 02 00 00.000
TFL 1 DAYS 9 HRS. 9 MIN. 52.127 SEC.

GEOCENTRIC EQUATORIAL COORDINATES

X	.22206297 06	Y	.11086693 06	Z	.22738660 05	DX	.96875120 00	DY	.75863059 00	DZ	.24387308 00
R	.24923976 06	DEC	.52343538 01	RA	.26531075 02	V	.12543816 01	PTH	.77120482 02	AZ	.61627205 02
R	.24923976 06	LAT	.52343538 01	LON	.48791051 02	VE	.17895364 02	PTE	.39181772 01	AZE	.27042640 03
XS	-.91259402 08	YS	.11136803 09	ZS	.48294012 08	DXS	-.23325942 02	DYS	-.16314916 02	DZS	-.70746968 01
XM	.37354349 06	YM	.79062670 05	ZM	-.28980230 04	DXM	-.23551377 00	DYM	.90984040 00	DZM	.41529410 00
XT	.37354349 06	YT	.79062670 05	ZT	-.28980230 04	DXT	-.23551377 00	DYT	.90984040 00	DZT	.41529410 00
RS	.15186648 09	VS	.29331338 02	RM	.38182986 06	VM	.10274947 01	RT	.38182986 06	VT	.10274947 01
GED	.52698246 01	ALT	.24286173 06	LOS	.15159253 03	RAS	.12933256 03	RAM	.11950615 02	LOM	.34210590 02
DUT	.35000000 02	DT	.19200000 04	DR	.12228226 01	SHA	.24516042 06	DES	.18542202 02	DEM	-.43486960 00

HELIOCENTRIC EQUATORIAL COORDINATES

X	.91481464 08	Y	-.11125716 09	Z	-.48271273 08	DX	.24294693 02	DY	.17073547 02	DZ	.73185699 01
R	.15191159 09	LAT	-.18527451 02	LON	.30942883 03	V	.30582667 02	PTH	-.37389224 00	AZ	.75510436 02
XE	.91259402 08	YE	-.11136803 09	ZE	-.48294012 08	DXE	.23325942 02	DYE	.16314916 02	DZE	.70746968 01
XT	.91632945 08	YT	-.11128897 09	ZT	-.48296910 08	DXT	.23090428 02	DYT	.17224757 02	DZT	.74899909 01
LTE	-.18542202 02	LOE	.30933256 03	LTT	-.18522145 02	LOT	.30946730 03	RST	.15203428 09	VST	.29765081 02
EPS	.79527032 02	ESP	.92523435-01	SEP	.10038050 03	EPM	.13903870 03	EMP	.25335013 02	MEP	.15626289 02
MPS	.14142727 03	MSP	.36342480-01	SMP	.38535859 02	SEM	.11600479 03	EMS	.63865875 02	ESM	.12877532 00
RPM	.15689190 06	SPN	.78060684 02								
GCE	.10097455 03	GCT	.28190016 03	SIP	.14079365 03	CPT	.92946210 02	SIN	.92312586 02	D1	.33177738 00
REP	.24923976 06	VEP	.12543816 01	CPE	.98122549 02	CPS	.76941731 02	D2	.26130679 00	D3	.46069051-02

0 DAYS 16 HRS. 32 MIN. 2.000 SEC. 2356665434142020000000000 J.D.= 2438606.62500000 JULY 30,1964 03 00 00.000
TFL 1 DAYS 10 HRS. 9 MIN. 52.127 SEC.

GEOCENTRIC EQUATORIAL COORDINATES

X	.22551491 06	Y	.11357931 06	Z	.23611997 05	DX	.94911923 00	DY	.74829320 00	DZ	.24165159 00
R	.25360355 06	DEC	.53423151 01	RA	.26731852 02	V	.12325443 01	PTH	.77139886 02	AZ	.61632881 02
R	.25360354 06	LAT	.53423151 01	LON	.33950765 02	VE	.18211497 02	PTE	.37832272 01	AZE	.27041096 03
XS	-.91343351 08	YS	.11130927 09	ZS	.48268533 08	DXS	-.23313605 02	DYS	-.16330129 02	DZS	-.70812822 01
XM	.37267808 06	YM	.82334214 05	ZM	-.14028917 04	DXM	-.24526571 00	DYM	.90767258 00	DZM	.41532896 00
XT	.37267808 06	YT	.82334214 05	ZT	-.14028917 04	DXT	-.24526571 00	DYT	.90767258 00	DZT	.41532896 00
RS	.15186577 09	VS	.29331585 02	RM	.38166718 06	VM	.10278730 01	RT	.38166718 06	VT	.10278730 01
GED	.53785091 01	ALT	.24722553 06	LOS	.13659212 03	RAS	.12937321 03	RAM	.12458005 02	LOM	.19676918 02
DUT	.35000000 02	DT	.19200000 04	DR	.12016277 01	SHA	.24959911 06	DES	.18532154 02	DEM	-.21060290 00

HELIOCENTRIC EQUATORIAL COORDINATES

X	.91568865 08	Y	-.11119569 09	Z	-.48244921 08	DX	.24262725 02	DY	.17078423 02	DZ	.73229337 01
R	.15191086 09	LAT	-.18517061 02	LON	.30947121 03	V	.30561048 02	PTH	-.37803645 00	AZ	.75493215 02
XE	.91343351 08	YE	-.11130927 09	ZE	-.48268533 08	DXE	.23313605 02	DYE	.16330129 02	DZE	.70812822 01
XT	.91716029 08	YT	-.11122693 09	ZT	-.48269936 08	DXT	.23068340 02	DYT	.17237802 02	DZT	.74966112 01
LTE	-.18532154 02	LOE	.30937321 03	LTT	-.18511913 02	LOT	.30950847 03	RST	.15203042 09	VST	.29757172 02
EPS	.79710464 02	ESP	.94614623-01	SEP	.10019539 03	EPM	.13868098 03	EMP	.26021730 02	MEP	.15297281 02
MPS	.14160116 03	MSP	.34970568-01	SMP	.38363139 02	SEM	.11549064 03	EMS	.64379517 02	ESM	.13028593 00
RPM	.15250902 06	SPN	.78269353 02								
GCE	.10095103 03	GCT	.28190733 03	SIP	.14094932 03	CPT	.92990560 02	SIN	.92338727 02	D1	.34131338 00
REP	.25360355 06	VEP	.12325443 01	CPE	.98148461 02	CPS	.76945842 02	D2	.26950699 00	D3	.49058101-02

0 DAYS 17 HRS. 32 MIN. 2.000 SEC. 2356665452202020000000000 J.D.= 2438606.66666666 JULY 30,1964 04 00 00.000
TFL 1 DAYS 11 HRS. 9 MIN. 52.127 SEC.

GEOCENTRIC EQUATORIAL COORDINATES

X	.22889753 06	Y	.11625496 06	Z	.24477978 05	DX	.93024357 00	DY	.73821837 00	DZ	.23945168 00
R	.25789236 06	DEC	.54464559 01	RA	.26925597 02	V	.12114688 01	PTH	.77157694 02	AZ	.61637127 02
R	.25789235 06	LAT	.54464559 01	LON	.19103442 02	VE	.18522100 02	PTE	.36562642 01	AZE	.27039650 03
XS	-.91427263 08	YS	.11125045 09	ZS	.48243028 08	DXS	-.23301257 02	DYS	-.16345337 02	DZS	-.70878651 01
XM	.37177758 06	YM	.85597811 05	ZM	.92301445 02	DXM	-.25500771 00	DYM	.90541714 00	DZM	.41532502 00
XT	.37177758 06	YT	.85597811 05	ZT	.92301445 02	DXT	-.25500771 00	DYT	.90541714 00	DZT	.41532502 00
RS	.15186506 09	VS	.29331833 02	RM	.38150434 06	VM	.10282529 01	RT	.38150434 06	VT	.10282529 01
GED	.54833469 01	ALT	.25151434 06	LOS	.12159171 03	RAS	.12941387 03	RAM	.12965785 02	LOM	.51436274 01
DUT	.35000000 02	DT	.19200000 04	DR	.11811645 01	SHA	.25396014 06	DES	.18522096 02	DEM	.13862183-01

HELIOCENTRIC EQUATORIAL COORDINATES

X	.91656160 08	Y	-.11113420 09	Z	-.48218549 08	DX	.24231500 02	DY	.17083555 02	DZ	.73273167 01
R	.15191014 09	LAT	-.18506663 02	LON	.30951356 03	V	.30540187 02	PTH	-.38178281 00	AZ	.75476161 02
XE	.91427263 08	YE	-.11125045 09	ZE	-.48243028 08	DXE	.23301257 02	DYE	.16345337 02	DZE	.70878651 01
XT	.91799040 08	YT	-.11116485 09	ZT	-.48242935 08	DXT	.23046249 02	DYT	.17250754 02	DZT	.75031900 01
LTE	-.18522096 02	LOE	.30941387 03	LTT	-.18501670 02	LOT	.30954962 03	RST	.15202654 09	VST	.29749217 02
EPS	.79885995 02	ESP	.95387001-01	SEP	.10001822 03	EPM	.13833785 03	EMP	.26702256 02	MEP	.14959888 02
MPS	.14176839 03	MSP	.32805301-01	SMP	.38197056 02	SEM	.11497605 03	EMS	.64893614 02	ESM	.13028593 00
RPM	.14815273 06	SPN	.78468855 02								
GCE	.10092865 03	GCT	.28191343 03	SIP	.14109739 03	CPT	.93033548 02	SIN	.92362548 02	D1	.35135074 00
REP	.25789236 06	VEP	.12114688 01	CPE	.98173290 02	CPS	.76949954 02	D2	.27811766 00	D3	.52296724-02

0 DAYS 18 HRS. 32 MIN. 2.000 SEC. 2356665470242020000000000 J.D.= 2438606.70833333 JULY 30,1964 05 00 00.000
TFL 1 DAYS 12 HRS. 9 MIN. 52.127 SEC.

GEOCENTRIC EQUATORIAL COORDINATES

X	.23221350 06	Y	.11889479 06	Z	.25336079 05	DX	.91208014 00	DY	.72838961 00	DZ	.23727216 00
R	.26210875 06	DEC	.55470134 01	RA	.27112734 02	V	.11911086 01	PTH	.77174324 02	AZ	.61639831 02
R	.26210875 06	LAT	.55470134 01	LON	.42495097 01	VE	.18827368 02	PTE	.35366087 01	AZE	.27038295 03
XS	-.91511127 08	YS	.11119158 09	ZS	.48217499 08	DXS	-.23288897 02	DYS	-.16360537 02	DZS	-.70944449 01
XM	.37084203 06	YM	.88853133 05	ZM	.15874106 04	DXM	-.26473879 00	DYM	.90307409 00	DZM	.41528217 00
XT	.37084203 06	YT	.88853133 05	ZT	.15874106 04	DXT	-.26473879 00	DYT	.90307409 00	DZT	.41528217 00
RS	.15186435 09	VS	.29332082 02	RM	.38134132 06	VM	.10286344 01	RT	.38134132 06	VT	.10286344 01
GED	.55845769 01	ALT	.25573075 06	LOS	.10659130 03	RAS	.12945452 03	RAM	.13473970 02	LOM	.35061074 03
DUT	.35000000 02	DT	.19200000 04	DR	.11613904 01	SHA	.25824619 06	DES	.18512028 02	DEM	.23850594 00

HELIOCENTRIC EQUATORIAL COORDINATES

X	.91743340 08	Y	-.11107268 09	Z	-.48192162 08	DX	.24200977 02	DY	.17088927 02	DZ	.73317170 01
R	.15190940 09	LAT	-.18496261 02	LON	.30955588 03	V	.30520039 02	PTH	-.38515522 00	AZ	.75459266 02
XE	.91511127 08	YE	-.11119158 09	ZE	-.48217499 08	DXE	.23288897 02	DYE	.16360537 02	DZE	.70944449 01
XT	.91881969 08	YT	-.11110272 09	ZT	-.48215912 08	DXT	.23024158 02	DYT	.17263611 02	DZT	.75097270 01
LTE	-.18512028 02	LOE	.30945452 03	LTT	-.18491421 02	LOT	.30959075 03	RST	.15202265 09	VST	.29741219 02
EPS	.80054107 02	ESP	.97917601-01	SEP	.99848489 02	EPM	.13800876 03	EMP	.27376648 02	MEP	.14614585 02
MPS	.14192903 03	MSP	.32805301-01	SMP	.38037541 02	SEM	.11446101 03	EMS	.65408164 02	ESM	.13066085 00
RPM	.14382061 06	SPN	.78659767 02								
GCE	.10090733 03	GCT	.28191837 03	SIP	.14123782 03	CPT	.93075239 02	SIN	.92384026 02	D1	.36193552 00
REP	.26210875 06	VEP	.11911086 01	CPE	.98197100 02	CPS	.76954067 02	D2	.28717696 00	D3	.55814223-02

0 DAYS 19 HRS. 32 MIN. 2.000 SEC. 2356655C630202000000C00 J.D.= 2438606.75000000 JULY 30,1964 06 00 00.000
TFL 1 DAYS 13 HRS. 9 MIN. 52.127 SEC.

GEOCENTRIC EQUATORIAL COORDINATES

X	.23546532 06	Y	.12149965 06	Z	.26186363 05	DX	.89458968 00	DY	.71879160 00	DZ	.23511169 00
R	.26625515 06	DEC	.56442019 01	RA	.27293645 02	V	.11714220 01	PTH	.77190197 02	AZ	.61640866 02
R	.26625515 06	LAT	.56442019 01	LON	.34938935 03	VE	.19127484 02	PTE	.34236604 01	AZE	.27037020 03
XS	-.91594943 08	YS	.11113265 09	ZS	.48191949 08	DXS	-.23276526 02	DYS	-.16375730 02	DZS	-.71010217 01
XM	.36987147 06	YM	.92099845 05	ZM	.30822892 04	DXM	-.27445794 00	DYM	.90064344 00	DZM	.41520035 00
XT	.36987147 06	YT	.92099845 05	ZT	.30822892 04	DXT	-.27445794 00	DYT	.90064344 00	DZT	.41520035 00
RS	.15186363 09	VS	.29332332 02	RM	.38117816 06	VM	.10290175 01	RT	.38117816 06	VT	.10290175 01
GED	.56824150 01	ALT	.25987715 06	LOS	.91590877 02	RAS	.12949517 03	RAM	.13982573 02	LOM	.33607828 03
DUT	.35000000 02	DT	.19200000 04	DR	.11422670 01	SHA	.26245975 06	DES	.18501952 02	DEM	.46331136 00

HELIOCENTRIC EQUATORIAL COORDINATES

X	.91830408 08	Y	-.11101115 09	Z	-.48165762 08	DX	.24171115 02	DY	.17094522 02	DZ	.73361333 01
R	.15190866 09	LAT	-.18485855 02	LON	.30959816 03	V	.30500563 02	PTH	-.38817075 00	AZ	.75442521 02
XE	.91594943 08	YE	-.11113265 09	ZE	-.48191949 08	DXE	.23276526 02	DYE	.16375730 02	DZE	.71010217 01
XT	.91964814 08	YT	-.11104055 09	ZT	-.48188866 08	DXT	.23002068 02	DYT	.17276374 02	DZT	.75162220 01
LTE	-.18501952 02	LOE	.30949517 03	LTT	-.18481165 02	LOT	.30963187 03	RST	.15201874 09	VST	.29733176 02
EPS	.80215233 02	ESP	.98911715-01	SEP	.99685772 02	EPM	.13769321 03	EMP	.28044962 02	MEP	.14261824 02
MPS	.14208314 03	MSP	.32051055-01	SMP	.37884548 02	SEM	.11394552 03	EMS	.65923172 02	ESM	.13122123 00
RPM	.13951044 06	SPN	.78842613 02								
GCE	.10088701 03	GCT	.28192206 03	SIP	.14137057 03	CPT	.93115703 02	SIN	.92403135 02	D1	.37311922 00
REP	.26625515 06	VEP	.11714220 01	CPE	.98219952 02	CPS	.76958182 02	D2	.29672752 00	D3	.59644289-02

0 DAYS 20 HRS. 32 MIN. 2.000 SEC. 2356665524342020000000C0 J.D.= 2438606.79166666 JULY 30,1964 07 00 00.000
TFL 1 DAYS 14 HRS. 9 MIN. 52.127 SEC.

GEOCENTRIC EQUATORIAL COORDINATES

X	.23865532 06	Y	.12407036 06	Z	.27028906 05	DX	.87773722 00	DY	.70941010 00	DZ	.23296884 00
R	.27033382 06	DEC	.57382186 01	RA	.27468683 02	V	.11523714 01	PTH	.77205765 02	AZ	.61640090 02
R	.27033382 06	LAT	.57382186 01	LON	.33452332 03	VE	.19422622 02	PTE	.33168884 01	AZE	.27035819 03
XS	-.91678720 08	YS	.11107367 09	ZS	.48166372 08	DXS	-.23264142 02	DYS	-.16390917 02	DZS	-.71075957 01
XM	.36886595 06	YM	.95337664 05	ZM	.45768C85 04	DXM	-.28416430 00	DYM	.89812518 00	DZM	.41507942 00
XT	.36886595 06	YT	.95337664 05	ZT	.45768C85 04	DXT	-.28416430 00	DYT	.89812518 00	DZT	.41507942 00
RS	.15186292 09	VS	.29332582 02	RM	.38101484 06	VM	.10294023 01	RT	.38101484 06	VT	.10294023 01
GED	.57770596 01	ALT	.26395583 06	LOS	.76590452 02	RAS	.12953581 03	RAM	.14491617 02	LOM	.32154626 03
DUT	.35000000 02	DT	.19200000 04	DR	.11237599 01	SHA	.26660321 06	DES	.18491867 02	DEM	.68826108 00

HELIOCENTRIC EQUATORIAL COORDINATES

X	.91917375 08	Y	-.11094960 09	Z	-.48139343 08	DX	.24141879 02	DY	.17100327 02	DZ	.73405645 01
R	.15190791 09	LAT	-.18475443 02	LON	.30964041 03	V	.30481722 02	PTH	-.39084562 00	AZ	.75425917 02
XE	.91678720 08	YE	-.11107367 09	ZE	-.48166372 08	DXE	.23264142 02	DYE	.16390917 02	DZE	.71075957 01
XT	.92047585 08	YT	-.11097834 09	ZT	-.48161795 08	DXT	.22979978 02	DYT	.17289042 02	DZT	.75226751 01
LTE	-.18491867 02	LOE	.30953581 03	LTT	-.18470901 02	LOT	.30967297 03	RST	.15201482 09	VST	.29725090 02
EPS	.80369771 02	ESP	.10087055 00	SEP	.99529669 02	EPM	.13739078 03	EMP	.28707231 02	MEP	.13901982 02
MPS	.14223074 03	MSP	.32805301-01	SMP	.37738037 02	SEM	.11342959 03	EMS	.66438639 02	ESM	.13177923 00
RPM	.13522009 06	SPN	.79017864 02								
GCE	.10086762 03	GCT	.28192439 03	SIP	.14149556 03	CPT	.93155009 02	SIN	.92419830 02	D1	.38495969 00
REP	.27033382 06	VEP	.11523714 01	CPE	.98241898 02	CPS	.76962300 02	D2	.30681725 00	D3	.63825909-02

0 DAYS 21 HRS. 32 MIN. 2.000 SEC. 2356665542402020000000C0 J.D.= 2438606.83333333 JULY 30,1964 08 00 00.000
TFL 1 DAYS 15 HRS. 9 MIN. 52.127 SEC.

GEOCENTRIC EQUATORIAL COORDINATES

X	.24178575 06	Y	.12660765 06	Z	.27863761 05	DX	.86149202 00	DY	.70023170 00	DZ	.23084207 00
R	.27434692 06	DEC	.58292385 01	RA	.27638158 02	V	.11339228 01	PTH	.77221467 02	AZ	.61637338 02
R	.27434692 06	LAT	.58292385 01	LON	.31965173 03	VE	.19712948 02	PTE	.32158118 01	AZE	.27034684 03
XS	-.91762447 08	YS	.11101464 09	ZS	.48140775 08	DXS	-.23251747 02	DYS	-.16406097 02	DZS	-.71141664 01
XM	.36782552 06	YM	.98566245 05	ZM	.6070817C 04	DXM	-.29385683 00	DYM	.89551934 00	DZM	.41491934 00
XT	.36782552 06	YT	.98566245 05	ZT	.6070817C 04	DXT	-.29385683 00	DYT	.89551934 00	DZT	.41491934 00
RS	.15186221 09	VS	.29332833 02	RM	.38085137 06	VM	.10297887 01	RT	.38085137 06	VT	.10297887 01
GED	.58686871 01	ALT	.26796893 06	LOS	.61590025 02	RAS	.12957644 03	RAM	.15001116 02	LOM	.30701469 03
DUT	.35000000 02	DT	.19200000 04	DR	.11058382 01	SHA	.27067879 06	DES	.18481774 02	DEM	.91333972 00

HELIOCENTRIC EQUATORIAL COORDINATES

X	.92004232 08	Y	-.11088803 09	Z	-.48112911 08	DX	.24113239 02	DY	.17106328 02	DZ	.73450085 01
R	.15190716 09	LAT	-.18465026 02	LON	.30968263 03	V	.30463485 02	PTH	-.39319264 00	AZ	.75409449 02
XE	.91762447 08	YE	-.11101464 09	ZE	-.48140775 08	DXE	.23251747 02	DYE	.16406097 02	DZE	.71141664 01
XT	.92130272 08	YT	-.11091607 09	ZT	-.48134704 08	DXT	.22957890 02	DYT	.17301616 02	DZT	.75290857 01
LTE	-.18481774 02	LOE	.30957644 03	LTT	-.18460632 02	LOT	.30971406 03	RST	.15201089 09	VST	.29716961 02
EPS	.80518076 02	ESP	.10231507 00	SEP	.99379827 02	EPM	.13710111 03	EMP	.29363469 02	MEP	.13535420 02
MPS	.14237187 03	MSP	.30486634-01	SMP	.37597993 02	SEM	.11291321 03	EMS	.66954564 02	ESM	.13233487 00
RPM	.13094760 06	SPN	.79185947 02								
GCE	.10084910 03	GCT	.28192524 03	SIP	.14161270 03	CPT	.93193226 02	SIN	.92434058 02	D1	.39752212 00
REP	.27434692 06	VEP	.11339228 01	CPE	.98262989 02	CPS	.76966418 02	D2	.31750012 00	D3	.68404336-02

0 DAYS 22 HRS. 32 MIN. 2.000 SEC. 2356665560442020000000C0 J.D.= 2438606.87500000 JULY 30,1964 09 00 00.000
TFL 1 DAYS 16 HRS. 9 MIN. 52.127 SEC.

GEOCENTRIC EQUATORIAL COORDINATES

X	.24485875 06	Y	.12911225 06	Z	.28690988 05	DX	.84582683 00	DY	.69124380 00	DZ	.22872973 00
R	.27829653 06	DEC	.59174257 01	RA	.27862356 02	V	.11160458 01	PTH	.77237808 02	AZ	.61632416 02
R	.27829652 06	LAT	.59174257 01	LON	.30477487 03	VE	.19998619 02	PTE	.31200056 01	AZE	.27033610 03
XS	-.91846132 08	YS	.11095555 09	ZS	.48115151 08	DXS	-.23239340 02	DYS	-.16421270 02	DZS	-.71207345 01
XM	.36675020 06	YM	.10178530 06	ZM	.75641824 04	DXM	-.30353467 00	DYM	.89282593 00	DZM	.41471998 00
XT	.36675020 06	YT	.10178530 06	ZT	.75641824 04	DXT	-.30353467 00	DYT	.89282593 00	DZT	.41471998 00
RS	.15186149 09	VS	.29333085 02	RM	.38068775 06	VM	.10301767 01	RT	.38068775 06	VT	.10301767 01
GED	.59574626 01	ALT	.27191855 06	LOS	.46589593 02	RAS	.12961708 03	RAM	.15511090 02	LOM	.29248360 03
DUT	.35000000 02	DT	.19200000 04	DR	.10884743 01	SHA	.27468864 06	DES	.18471672 02	DEM	.11385276 01

HELIOCENTRIC EQUATORIAL COORDINATES

X	.92090990 08	Y	-.11082644 09	Z	-.48086460 08	DX	.24085167 02	DY	.17112514 02	DZ	.73494642 01
R	.15190641 09	LAT	-.18454604 02	LON	.30972482 03	V	.30445820 02	PTH	-.39521950 00	AZ	.75393111 02
XE	.91846132 08	YE	-.11095555 09	ZE	-.48115151 08	DXE	.23239340 02	DYE	.16421270 02	DZE	.71207345 01
XT	.92212882 08	YT	-.11085376 09	ZT	-.48107586 08	DXT	.22935805 02	DYT	.17314096 02	DZT	.75354544 01
LTE	-.18471672 02	LOE	.30961708 03	LTT	-.18450352 02	LOT	.30975512 03	RST	.15200695 09	VST	.29708789 02
EPS	.80660470 02	ESP	.10397499 00	SEP	.99235921 02	EPM	.13682385 03	EMP	.30013679 02	MEP	.13162464 02
MPS	.14250652 03	MSP	.30486634-01	SMP	.37464413 02	SEM	.11239638 03	EMS	.67470951 02	ESM	.13251956 00
RPM	.12669107 06	SPN	.79347251 02								
GCE	.10083140 03	GCT	.28192447 03	SIP	.14172184 03	CPT	.93230429 02	SIN	.92445753 02	D1	.41088042 00
REP	.27829653 06	VEP	.11160458 01	CPE	.98283266 02	CPS	.76970541 02	D2	.32883730 00	D3	.73432410-02

0 DAYS 23 HRS. 32 MIN. 2.000 SEC. 2356665576502020000000000 J.D.= 2438606.91666666 JULY 30,1964 10 00 00.000
TFL 1 DAYS 17 HRS. 9 MIN. 52.127 SEC.

GEOCENTRIC EQUATORIAL COORDINATES

X	.24787637 06	Y	.13158482 06	Z	.29510635 05	DX	.83071815 00	DY	.68243442 00	DZ	.22663002 00
R	.28218457 06	DEC	.60029234 01	RA	.27961534 02	V	.10987131 01	PTH	.77255323 02	AZ	.61625101 02
R	.28218457 06	LAT	.60029234 01	LON	.28989298 03	VE	.20279788 02	PTE	.30290898 01	AZE	.27032590 03
XS	-.91929776 08	YS	.11089640 09	ZS	.48089503 08	DXS	-.23226921 02	DYS	-.16436437 02	DZS	-.71272998 01
XM	.36564008 06	YM	.10499450 06	ZM	.90567602 04	DXM	-.31319682 00	DYM	.89004498 00	DZM	.41448129 00
XT	.36564008 06	YT	.10499450 06	ZT	.90567602 04	DXT	-.31319682 00	DYT	.89004498 00	DZT	.41448129 00
RS	.15186078 09	VS	.29333338 02	RM	.38052402 06	VM	.10305664 01	RT	.38052402 06	VT	.10305664 01
GED	.60435303 01	ALT	.27580660 06	LOS	.31589156 02	RAS	.12965771 03	RAM	.16021556 02	LOM	.27795300 03
DUT	.35000000 02	DT	.19200000 04	DR	.10716440 01	SHA	.27863477 06	DES	.18461559 02	DEM	.13638112 01

HELIOCENTRIC EQUATORIAL COORDINATES

X	.92177652 08	Y	-.11076482 09	Z	-.48059992 08	DX	.24057639 02	DY	.17118871 02	DZ	.73539298 01
R	.15190565 09	LAT	-.18444175 02	LON	.30976697 03	V	.30428704 02	PTH	-.39693046 00	AZ	.75376893 02
XE	.91929776 08	YE	-.11089640 09	ZE	-.48089503 08	DXE	.23226921 02	DYE	.16436437 02	DZE	.71272998 01
XT	.92295416 08	YT	-.11079141 09	ZT	-.48080446 08	DXT	.22913724 02	DYT	.17326482 02	DZT	.75417811 01
LTE	-.18461559 02	LOE	.30965771 03	LTT	-.18440066 02	LOT	.30979618 03	RST	.15200299 09	VST	.29700575 02
EPS	.80797242 02	ESP	.10491172 00	SEP	.99097661 02	EPM	.13655876 03	EMP	.30657835 02	MEP	.12783399 02
MPS	.14263466 03	MSP	.27976454-01	SMP	.37337321 02	SEM	.11187910 03	EMS	.67987797 02	ESM	.13325579 00
RPM	.12244876 06	SPN	.79502120 02								
GCE	.10081448 03	GCT	.28192193 03	SIP	.14182280 03	CPT	.93266688 02	SIN	.92454826 02	D1	.42511845 00
REP	.28218457 06	VEP	.10987131 01	CPE	.98302767 02	CPS	.76974665 02	D2	.34089823 00	D3	.78972032-02

1 DAYS 0 HRS. 32 MIN. 2.000 SEC. 2356665614542020000000000 J.D.= 2438606.95833333 JULY 30,1964 11 00 00.000
TFL 1 DAYS 18 HRS. 9 MIN. 52.127 SEC.

GEOCENTRIC EQUATORIAL COORDINATES

X	.25084056 06	Y	.13402598 06	Z	.30322739 05	DX	.81614577 00	DY	.67379209 00	DZ	.22454100 00
R	.28601297 06	DEC	.60858658 01	RA	.28115919 02	V	.10819003 01	PTH	.77274582 02	AZ	.61615139 02
R	.28601296 06	LAT	.60858658 01	LON	.27500630 03	VE	.20556602 02	PTE	.29427169 01	AZE	.27031619 03
XS	-.92013369 08	YS	.11083720 09	ZS	.48063835 08	DXS	-.23214491 02	DYS	-.16451596 02	DZS	-.71338619 01
XM	.36449520 06	YM	.10819352 06	ZM	.10548403 05	DXM	-.32284227 00	DYM	.88717656 00	DZM	.41420318 00
XT	.36449520 06	YT	.10819352 06	ZT	.10548403 05	DXT	-.32284227 00	DYT	.88717656 00	DZT	.41420318 00
RS	.15186006 09	VS	.29333591 02	RM	.38036016 06	VM	.10309576 01	RT	.38036016 06	VT	.10309576 01
GED	.61270253 01	ALT	.27963500 06	LOS	.16588714 02	RAS	.12969833 03	RAM	.16532527 02	LOM	.26342291 03
DUT	.35000000 02	DT	.19200000 04	DR	.10553256 01	SHA	.28251913 06	DES	.18451440 02	DEM	.15891673 01

HELIOCENTRIC EQUATORIAL COORDINATES

X	.92264209 08	Y	-.11070318 09	Z	-.48033512 08	DX	.24030637 02	DY	.17125387 02	DZ	.73584028 01
R	.15190489 09	LAT	-.18433742 02	LON	.30980910 03	V	.30412111 02	PTH	-.39833150 00	AZ	.75360794 02
XE	.92013369 08	YE	-.11083720 09	ZE	-.48063835 08	DXE	.23214491 02	DYE	.16451596 02	DZE	.71338619 01
XT	.92377864 08	YT	-.11072901 09	ZT	-.48053287 08	DXT	.22891649 02	DYT	.17338772 02	DZT	.75480650 01
LTE	-.18451440 02	LOE	.30969833 03	LTT	-.18429773 02	LOT	.30983722 03	RST	.15199902 09	VST	.29692321 02
EPS	.80928658 02	ESP	.10721774 00	SEP	.98964778 02	EPM	.13630561 03	EMP	.31295892 02	MEP	.12398491 02
MPS	.14275627 03	MSP	.27976454-01	SMP	.37216759 02	SEM	.11136136 03	EMS	.68505109 02	ESM	.13380530 00
RPM	.11821893 06	SPN	.79650876 02								
GCE	.10079829 03	GCT	.28191746 03	SIP	.14191535 03	CPT	.93302087 02	SIN	.92461175 02	D1	.44033225 00
REP	.28601297 06	VEP	.10819003 01	CPE	.98321526 02	CPS	.76978791 02	D2	.35376236 00	D3	.85096272-02

1 DAYS 1 HRS. 32 MIN. 2.000 SEC. 2356665632602020000000000 J.D.= 2438607.00000000 JULY 30,1964 12 00 00.000
TFL 1 DAYS 19 HRS. 9 MIN. 52.127 SEC.

GEOCENTRIC EQUATORIAL COORDINATES

X	.25375323 06	Y	.13643632 06	Z	.31127343 05	DX	.80209263 00	DY	.66530585 00	DZ	.22246056 00
R	.28978351 06	DEC	.61663732 01	RA	.28265727 02	V	.10655858 01	PTH	.77296239 02	AZ	.61602215 02
R	.28978351 06	LAT	.61663732 01	LON	.26011503 03	VE	.20829202 02	PTE	.28605865 01	AZE	.27030694 03
XS	-.92096923 08	YS	.11077795 09	ZS	.48038140 08	DXS	-.23202048 02	DYS	-.16466749 02	DZS	-.71404214 01
XM	.36331563 06	YM	.11138207 06	ZM	.12038978 05	DXM	-.33247014 00	DYM	.88422067 00	DZM	.41388557 00
XT	.36331563 06	YT	.11138207 06	ZT	.12038978 05	DXT	-.33247014 00	DYT	.88422067 00	DZT	.41388557 00
RS	.15185934 09	VS	.29333846 02	RM	.38019620 06	VM	.10313505 01	RT	.38019620 06	VT	.10313505 01
GED	.62080687 01	ALT	.28340555 06	LOS	.15882702 01	RAS	.12973895 03	RAM	.17044025 02	LOM	.24889334 03
DUT	.35000000 02	DT	.19200000 04	DR	.10395004 01	SHA	.28634357 06	DES	.18441311 02	DEM	.18145823 01

HELIOCENTRIC EQUATORIAL COORDINATES

X	.92350676 08	Y	-.11064151 09	Z	-.48007012 08	DX	.24004141 02	DY	.17132055 02	DZ	.73628819 01
R	.15190413 09	LAT	-.18423303 02	LON	.30985121 03	V	.30396021 02	PTH	-.39942092 00	AZ	.75344808 02
XE	.92096923 08	YE	-.11077795 09	ZE	-.48038140 08	DXE	.23202048 02	DYE	.16466749 02	DZE	.71404214 01
XT	.92460238 08	YT	-.11066656 09	ZT	-.48026101 08	DXT	.22869578 02	DYT	.17350970 02	DZT	.75543070 01
LTE	-.18441311 02	LOE	.30973896 03	LTT	-.18419471 02	LOT	.30987824 03	RST	.15199503 09	VST	.29684024 02
EPS	.81054554 02	ESP	.10744563 00	SEP	.98837039 02	EPM	.13606423 03	EMP	.31927777 02	MEP	.12007982 02
MPS	.14287126 03	MSP	.25217635-01	SMP	.37102797 02	SEM	.11084317 03	EMS	.69022884 02	ESM	.13398797 00
RPM	.11400000 06	SPN	.79793799 02								
GCE	.10078279 03	GCT	.28191085 03	SIP	.14199922 03	CPT	.93336713 02	SIN	.92464679 02	D1	.45663185 00
REP	.28978351 06	VEP	.10655858 01	CPE	.98339575 02	CPS	.76982919 02	D2	.36752080 00	D3	.91891720-02

1 DAYS 2 HRS. 32 MIN. 2.000 SEC. 2356665650642020000000000 J.D.= 2438607.04166666 JULY 30,1964 13 00 00.000
TFL 1 DAYS 20 HRS. 9 MIN. 52.127 SEC.

GEOCENTRIC — EQUATORIAL COORDINATES

X	.25661623 06	Y	.13881637 06	Z	.31924468 05	DX	.78854511 00	DY	.65696500 00	DZ	.22038640 00
R	.29349795 06	DEC	.62445541 01	RA	.28411139 02	V	.10497507 01	PTH	.77320994 02	AZ	.61585975 02
R	.29349794 06	LAT	.62445541 01	LON	.24521938 03	VE	.21097727 02	PTE	.27824158 01	AZE	.27029810 03
XS	-.92180430 08	YS	.11071864 09	ZS	.48012421 08	DXS	-.23189594 02	DYS	-.16481895 02	DZS	-.71469779 01
XM	.36210143 06	YM	.11455982 06	ZM	.1352834C 05	DXM	-.34207943 00	DYM	.88117741 00	DZM	.41352839 00
XT	.36210143 06	YT	.11455982 06	ZT	.1352834C 05	DXT	-.34207943 00	DYT	.88117741 00	DZT	.41352839 00
RS	.15185862 09	VS	.29334100 02	RM	.38003212 06	VM	.10317450 01	RT	.38003212 06	VT	.10317450 01
GED	.62867698 01	ALT	.28712000 06	LOS	.34658782 03	RAS	.12977957 03	RAM	.17556066 02	LOM	.23436431 03
DUT	.35000000 02	DT	.19200000 04	DR	.10241526 01	SHA	.29010989 06	DES	.18431173 02	DEM	.20400392 01

HELIOCENTRIC — EQUATORIAL COORDINATES

X	.92437046 08	Y	-.11057982 09	Z	-.47980497 08	DX	.23978139 02	DY	.17138860 02	DZ	.73673642 01
R	.15190336 09	LAT	-.18412857 02	LON	.30989328 03	V	.30380416 02	PTH	-.40019700 00	AZ	.75328933 02
XE	.92180430 08	YE	-.11071864 09	ZE	-.48012421 08	DXE	.23189594 02	DYE	.16481895 02	DZE	.71469779 01
XT	.92542531 08	YT	-.11060408 09	ZT	-.47998893 08	DXT	.22847514 02	DYT	.17363073 02	DZT	.75605062 01
LTE	-.18431173 02	LOE	.30977957 03	LTT	-.18409163 02	LOT	.30991925 03	RST	.15199104 09	VST	.29675687 02
EPS	.81176346 02	ESP	.10969840 00	SEP	.98714228 02	EPM	.13583452 03	EMP	.32553389 02	MEP	.11612083 02
MPS	.14297554 03	MSP	.27088C86-01	SMP	.3699554C 02	SEM	.11032453 03	EMS	.69541126 02	ESM	.13453449 00
RPM	.10979037 06	SPN	.79931154 02								
GCE	.10076794 03	GCT	.28190190 03	SIP	.14207406 03	CPT	.93370654 02	SIN	.92465180 02	D1	.47414450 00
REP	.29349795 06	VEP	.10497507 01	CPE	.98356936 02	CPS	.76987052 02	D2	.38227880 00	D3	.99461753-02

1 DAYS 3 HRS. 32 MIN. 2.000 SEC. 2356665666702020000000000 J.D.= 2438607.08333333 JULY 30,1964 14 00 00.000
TFL 1 DAYS 21 HRS. 9 MIN. 52.127 SEC.

GEOCENTRIC — EQUATORIAL COORDINATES

X	.25943135 06	Y	.14116663 06	Z	.32714131 05	DX	.77549295 00	DY	.64875905 00	DZ	.21831596 00
R	.29715797 06	DEC	.63205067 01	RA	.28552319 02	V	.10343788 01	PTH	.77349669 02	AZ	.61565980 02
R	.29715796 06	LAT	.63205067 01	LON	.23031950 03	VE	.21362312 02	PTE	.27079625 01	AZE	.27028961 03
XS	-.92263888 08	YS	.11065928 09	ZS	.47986681 08	DXS	-.23177129 02	DYS	-.16497034 02	DZS	-.71535312 01
XM	.36085268 06	YM	.11772645 06	ZM	.15016338 05	DXM	-.35166913 00	DYM	.87804683 00	DZM	.41313159 00
XT	.36085268 06	YT	.11772645 06	ZT	.15016338 05	DXT	-.35166913 00	DYT	.87804683 00	DZT	.41313159 00
RS	.15185790 09	VS	.29334356 02	RM	.37986796 06	VM	.10321410 01	RT	.37986796 06	VT	.10321410 01
GED	.63632274 01	ALT	.29078C02 06	LOS	.33158736 03	RAS	.12982018 03	RAM	.18068666 02	LOM	.21983585 03
DUT	.35000000 02	DT	.19200000 04	DR	.1009269C 01	SHA	.29381981 06	DES	.18421028 02	DEM	.22655148 01

HELIOCENTRIC — EQUATORIAL COORDINATES

X	.92523319 08	Y	-.11051811 09	Z	-.47953967 08	DX	.23952622 02	DY	.17145793 02	DZ	.73718472 01
R	.15190260 09	LAT	-.18402407 02	LON	.30993532 03	V	.30365283 02	PTH	-.40065121 00	AZ	.75313163 02
XE	.92263888 08	YE	-.11065928 09	ZE	-.47986681 08	DXE	.23177129 02	DYE	.16497034 02	DZE	.71535312 01
XT	.92624740 08	YT	-.11054155 09	ZT	-.47971664 08	DXT	.22825459 02	DYT	.17375081 02	DZT	.75666627 01
LTE	-.18421028 02	LOE	.30982018 03	LTT	-.18398848 02	LOT	.30996025 03	RST	.15198703 09	VST	.29667312 02
EPS	.81293019 02	ESP	.11102813 00	SEP	.98596155 02	EPM	.13561644 03	EMP	.33172582 02	MEP	.11210971 02
MPS	.14308097 03	MSP	.23196850-01	SMP	.36895120 02	SEM	.10980543 03	EMS	.70059838 02	ESM	.13453449 00
RPM	.10558854 06	SPN	.80063167 02								
GCE	.10075371 03	GCT	.28189C35 03	SIP	.14213946 03	CPT	.93404008 02	SIN	.92462499 02	D1	.49301779 00
REP	.29715797 06	VEP	.10343788 01	CPE	.98373635 02	CPS	.76991186 02	D2	.39815850 00	D3	.10793056-01

1 DAYS 4 HRS. 32 MIN. 2.000 SEC. 2356665704742020000000000 J.D.= 2438607.12500000 JULY 30,1964 15 00 00.000
TFL 1 DAYS 22 HRS. 9 MIN. 52.127 SEC.

GEOCENTRIC — EQUATORIAL COORDINATES

X	.26220035 06	Y	.14348759 06	Z	.33496346 05	DX	.76292921 00	DY	.64067767 00	DZ	.21624642 00
R	.30076522 06	DEC	.63943206 01	RA	.28689419 02	V	.10194564 01	PTH	.77383184 02	AZ	.61541726 02
R	.30076522 06	LAT	.63943206 01	LON	.21541554 03	VE	.21623091 02	PTE	.26370045 01	AZE	.27028146 03
XS	-.92347308 08	YS	.11059986 09	ZS	.47960915 08	DXS	-.23164650 02	DYS	-.16512167 02	DZS	-.71600819 01
XM	.35956945 06	YM	.12088166 06	ZM	.16502843 05	DXM	-.36123834 00	DYM	.87482901 00	DZM	.41269508 00
XT	.35956945 06	YT	.12088166 06	ZT	.16502843 05	DXT	-.36123834 00	DYT	.87482901 00	DZT	.41269508 00
RS	.15185718 09	VS	.29334611 02	RM	.37970370 06	VM	.10325387 01	RT	.37970370 06	VT	.10325387 01
GED	.64375319 01	ALT	.29438728 06	LOS	.31658690 03	RAS	.12986079 03	RAM	.18581845 02	LOM	.20530796 03
DUT	.35000000 02	DT	.19200000 04	DR	.99483930 00	SHA	.29747502 06	DES	.18410871 02	DEM	.24909964 01

HELIOCENTRIC — EQUATORIAL COORDINATES

X	.92609508 08	Y	-.11045637 09	Z	-.47927419 08	DX	.23927579 02	DY	.17152844 02	DZ	.73763282 01
R	.15190183 09	LAT	-.18391950 02	LON	.30997735 03	V	.30350607 02	PTH	-.40077244 00	AZ	.75297496 02
XE	.92347308 08	YE	-.11059986 09	ZE	-.47960915 08	DXE	.23164650 02	DYE	.16512167 02	DZE	.71600819 01
XT	.92706877 08	YT	-.11047897 09	ZT	-.47944412 08	DXT	.22803412 02	DYT	.17386996 02	DZT	.75727769 01
LTE	-.18410871 02	LOE	.30986079 03	LTT	-.18388526 02	LOT	.31000122 03	RST	.15198301 09	VST	.29658896 02
EPS	.81405140 02	ESP	.11212418 00	SEP	.98482652 02	EPM	.13540998 03	EMP	.33785180 02	MEP	.10804835 02
MPS	.14317537 03	MSP	.19782341-01	SMP	.36801722 02	SEM	.10928587 03	EMS	.70579015 02	ESM	.13525975 00
RPM	.10139303 06	SPN	.80190041 02								
GCE	.10074C07 03	GCT	.28187591 03	SIP	.14219489 03	CPT	.93436889 02	SIN	.92456417 02	D1	.51342408 00
REP	.30076522 06	VEP	.10194564 01	CPE	.98389688 02	CPS	.76995324 02	D2	.41530246 00	D3	.11744834-01

1 DAYS 5 HRS. 32 MIN. 2.000 SEC. 2356665723002020000000000 J.D.= 2438607.16666666 JULY 30,1964 16 00 00.000
TFL 1 DAYS 23 HRS. 9 MIN. 52.127 SEC.

GEOCENTRIC — EQUATORIAL COORDINATES

X	.26492502 06	Y	.14577965 06	Z	.34271105 05	DX	.75085090 00	DY	.63271033 00	DZ	.21417459 00
R	.30432134 06	DEC	.64660734 01	RA	.28822562 02	V	.10049727 01	PTH	.77422620 02	AZ	.61512573 02
R	.30432134 06	LAT	.64660734 01	LON	.20050762 03	VE	.21880197 02	PTE	.25693421 01	AZE	.27027360 03
XS	-.92430678 08	YS	.11054C39 09	ZS	.47935129 08	DXS	-.23152161 02	DYS	-.16527292 02	DZS	-.71666291 01
XM	.35825180 06	YM	.124C2512 06	ZM	.17987698 05	DXM	-.37078602 00	DYM	.87152404 00	DZM	.41221883 00
XT	.35825180 06	YT	.12402512 06	ZT	.17987698 05	DXT	-.37078602 00	DYT	.87152404 00	DZT	.41221883 00
RS	.15185646 09	VS	.29334868 02	RM	.37953937 06	VM	.10329379 01	RT	.37953937 06	VT	.10329379 01
GED	.65097613 01	ALT	.29794341 06	LOS	.30158644 03	RAS	.12990139 03	RAM	.19095618 02	LOM	.19078067 03
DUT	.35000000 02	DT	.19200000 04	DR	.98085621 00	SHA	.30107716 06	DES	.18400709 02	DEM	.27164644 01

HELIOCENTRIC — EQUATORIAL COORDINATES

X	.92695603 08	Y	-.11039461 09	Z	-.47900857 08	DX	.23903012 02	DY	.17160002 02	DZ	.73808037 01
R	.15190107 09	LAT	-.18381489 02	LON	.31001934 03	V	.30336379 02	PTH	-.40054534 00	AZ	.75281931 02
XE	.92430678 08	YE	-.11054C39 09	ZE	-.47935129 08	DXE	.23152161 02	DYE	.16527292 02	DZE	.71666291 01
XT	.92788929 08	YT	-.11041636 09	ZT	-.47917141 08	DXT	.22781375 02	DYT	.17398816 02	DZT	.75788480 01
LTE	-.18400709 02	LOE	.30990139 03	LTT	-.18378197 02	LOT	.31004218 03	RST	.15197898 09	VST	.29650443 02
EPS	.81512862 02	ESP	.11342548 00	SEP	.98373571 02	EPM	.13521524 03	EMP	.34390951 02	MEP	.10393800 02
MPS	.14326251 03	MSP	.19782341-01	SMP	.36715568 02	SEM	.10876585 03	EMS	.71098663 02	ESM	.13544046 00
RPM	.97202347 05	SPN	.80311964 02								
GCE	.10072699 03	GCT	.28185824 03	SIP	.14223976 03	CPT	.93469418 02	SIN	.92446671 02	D1	.53556621 00
REP	.30432134 06	VEP	.10049727 01	CPE	.98405114 02	CPS	.76999465 02	D2	.43387853 00	D3	.12819846-01

1 DAYS 6 HRS. 32 MIN. 2.000 SEC. 2356665741042020000000000 J.D.= 2438607.20833333 JULY 30,1964 17 00 00.000
TFL 2 DAYS 0 HRS. 9 MIN. 52.127 SEC.

GEOCENTRIC EQUATORIAL COORDINATES

X	.26760707 06	Y	.14804323 06	Z	.35038398 05	DX	.73925903 00	DY	.62484653 00	DZ	.21209685 00
R	.30782793 06	DEC	.65358370 01	RA	.28951857 02	V	.99091986 00	PTH	.77469193 02	AZ	.61477777 02
R	.30782792 06	LAT	.65358370 01	LON	.18559584 03	VE	.22133763 02	PTE	.25048045 01	AZE	.27026600 03
XS	-.92514004 08	YS	.11048086 09	ZS	.47909316 08	DXS	-.23139659 02	DYS	-.16542411 02	DZS	-.71731738 01
XM	.35689981 06	YM	.12715653 06	ZM	.19470771 05	DXM	-.38031124 00	DYM	.86813200 00	DZM	.41170275 00
XT	.35689981 06	YT	.12715653 06	ZT	.19470771 05	DXT	-.38031124 00	DYT	.86813200 00	DZT	.41170275 00
RS	.15185573 09	VS	.29335126 02	RM	.37937497 06	VM	.10333387 01	RT	.37937497 06	VT	.10333387 01
GED	.65799880 01	ALT	.30145000 06	LOS	.28658598 03	RAS	.12994199 03	RAM	.19610007 02	LOM	.17625399 03
DUT	.35000000 02	DT	.19200000 04	DR	.96731566 00	SHA	.30462784 06	DES	.18390535 02	DEM	.29418990 01

HELIOCENTRIC EQUATORIAL COORDINATES

X	.92781611 08	Y	-.11033282 09	Z	-.47874277 08	DX	.23878918 02	DY	.17167258 02	DZ	.73852706 01
R	.15190031 09	LAT	-.18371019 02	LON	.31006132 03	V	.30322593 02	PTH	-.39995112 00	AZ	.75266465 02
XE	.92514004 08	YE	-.11048086 09	ZE	-.47909316 08	DXE	.23139659 02	DYE	.16542411 02	DZE	.71731738 01
XT	.92870903 08	YT	-.11035370 09	ZT	-.47889845 08	DXT	.22759348 02	DYT	.17410543 02	DZT	.75848765 01
LTE	-.18390535 02	LOE	.30994199 03	LTT	-.18367860 02	LOT	.31008312 03	RST	.15197494 09	VST	.29641951 02
EPS	.81616308 02	ESP	.11471201 00	SEP	.98268786 02	EPM	.13503239 03	EMP	.34989594 02	MEP	.99780111 01
MPS	.14334210 03	MSP	.22117329-01	SMP	.36636959 02	SEM	.10824537 03	EMS	.71618784 02	ESM	.13580115 00
RPM	.93015037 05	SPN	.80429091 02								
GCE	.10071445 03	GCT	.28183693 03	SIP	.14227330 03	CPT	.93501730 02	SIN	.92432936 02	D1	.55968431 00
REP	.30782793 06	VEP	.99091986 00	CPE	.98419923 02	CPS	.77003609 02	D2	.45408528 00	D3	.14040630-01

1 DAYS 7 HRS. 32 MIN. 2.000 SEC. 23566657571020200000000000 J.D.= 2438607.25000000 JULY 30,1964 18 00 00.000
TFL 2 DAYS 1 HRS. 9 MIN. 52.127 SEC.

GEOCENTRIC EQUATORIAL COORDINATES

X	.27024827 06	Y	.15027867 06	Z	.35798195 05	DX	.72815944 00	DY	.61707520 00	DZ	.21000909 00
R	.31128655 06	DEC	.66036710 01	RA	.29077398 02	V	.97729307 00	PTH	.77524392 02	AZ	.61436388 02
R	.31128655 06	LAT	.66036710 01	LON	.17068032 03	VE	.22383924 02	PTE	.24432337 01	AZE	.27025862 03
XS	-.92597287 08	YS	.11042128 09	ZS	.47883480 08	DXS	-.23127146 02	DYS	-.16557523 02	DZS	-.71797156 01
XM	.35551357 06	YM	.13027558 06	ZM	.20951916 05	DXM	-.38981302 00	DYM	.86465300 00	DZM	.41114680 00
XT	.35551357 06	YT	.13027558 06	ZT	.20951916 05	DXT	-.38981302 00	DYT	.86465300 00	DZT	.41114680 00
RS	.15185501 09	VS	.29335384 02	RM	.37921050 06	VM	.10337411 01	RT	.37921050 06	VT	.10337411 01
GED	.66482721 01	ALT	.30490862 06	LOS	.27158551 03	RAS	.12998259 03	RAM	.20125025 02	LOM	.16172795 03
DUT	.35000000 02	DT	.19200000 04	DR	.95421729 00	SHA	.30812862 06	DES	.18380354 02	DEM	.31672842 01

HELIOCENTRIC EQUATORIAL COORDINATES

X	.92867535 08	Y	-.11027100 09	Z	-.47847681 08	DX	.23855305 02	DY	.17174598 02	DZ	.73897246 01
R	.15189955 09	LAT	-.18360544 02	LON	.31010326 03	V	.30309246 02	PTH	-.39895988 00	AZ	.75251096 02
XE	.92597287 08	YE	-.11042128 09	ZE	-.47883480 08	DXE	.23127146 02	DYE	.16557523 02	DZE	.71797156 01
XT	.92952800 08	YT	-.11029100 09	ZT	-.47862528 08	DXT	.22737333 02	DYT	.17422176 02	DZT	.75908624 01
LTE	-.18380354 02	LOE	.30998259 03	LTT	-.18357515 02	LOT	.31012405 03	RST	.15197088 09	VST	.29633422 02
EPS	.81715585 02	ESP	.11640527 00	SEP	.98168188 02	EPM	.13486170 03	EMP	.35580740 02	MEP	.95575556 01
MPS	.14341378 03	MSP	.18504685-01	SMP	.36566255 02	SEM	.10772444 03	EMS	.72139378 02	ESM	.13598114 00
RPM	.88829650 05	SPN	.80541560 02								
GCE	.10070241 03	GCT	.28181152 03	SIP	.14229462 03	CPT	.93533988 02	SIN	.92414830 02	D1	.58606480 00
REP	.31128655 06	VEP	.97729307 00	CPE	.98434120 02	CPS	.77007757 02	D2	.47615962 00	D3	.15435163-01

1 DAYS 8 HRS. 32 MIN. 2.000 SEC. 23566657751420200000000000 J.D.= 2438607.29166666 JULY 30,1964 19 00 00.000
TFL 2 DAYS 2 HRS. 9 MIN. 52.127 SEC.

GEOCENTRIC EQUATORIAL COORDINATES

X	.27285042 06	Y	.15248627 06	Z	.36550448 05	DX	.71756338 00	DY	.60938466 00	DZ	.20790648 00
R	.31469882 06	DEC	.66696276 01	RA	.29199250 02	V	.96409126 00	PTH	.77589921 02	AZ	.61387239 02
R	.31469883 06	LAT	.66696276 01	LON	.15576111 03	VE	.22630820 02	PTE	.23845018 01	AZE	.27025142 03
XS	-.92680522 08	YS	.11036164 09	ZS	.47857623 08	DXS	-.23114621 02	DYS	-.16572627 02	DZS	-.71862541 01
XM	.35409318 06	YM	.13338193 06	ZM	.22430983 05	DXM	-.39929032 00	DYM	.86108716 00	DZM	.41055095 00
XT	.35409318 06	YT	.13338193 06	ZT	.22430983 05	DXT	-.39929032 00	DYT	.86108716 00	DZT	.41055095 00
RS	.15185428 09	VS	.29335642 02	RM	.37904599 06	VM	.10341450 01	RT	.37904599 06	VT	.10341450 01
GED	.67146660 01	ALT	.30832091 06	LOS	.25658503 03	RAS	.13002318 03	RAM	.20640690 02	LOM	.14720254 03
DUT	.35000000 02	DT	.19200000 04	DR	.94156480 00	SHA	.31158114 06	DES	.18370165 02	DEM	.33926010 01

HELIOCENTRIC EQUATORIAL COORDINATES

X	.92953372 08	Y	-.11020916 09	Z	-.47821072 08	DX	.23832184 02	DY	.17182012 02	DZ	.73941606 01
R	.15189879 09	LAT	-.18350064 02	LON	.31014518 03	V	.30296339 02	PTH	-.39753835 00	AZ	.75235826 02
XE	.92680522 08	YE	-.11036164 09	ZE	-.47857623 08	DXE	.23114621 02	DYE	.16572627 02	DZE	.71862541 01
XT	.93034615 08	YT	-.11022826 09	ZT	-.47835192 08	DXT	.22715331 02	DYT	.17433714 02	DZT	.75968050 01
LTE	-.18370165 02	LOE	.31002318 03	LTT	-.18347165 02	LOT	.31016496 03	RST	.15196682 09	VST	.29624856 02
EPS	.81810775 02	ESP	.11703392 00	SEP	.98071696 02	EPM	.13470352 03	EMP	.36163932 02	MEP	.91325361 01
MPS	.14347709 03	MSP	.15639313-01	SMP	.36503914 02	SEM	.10720304 03	EMS	.72660445 02	ESM	.13634040 00
RPM	.84644669 05	SPN	.80649482 02								
GCE	.10069086 03	GCT	.28178145 03	SIP	.14230259 03	CPT	.93566377 02	SIN	.92391878 02	D1	.61505277 00
REP	.31469882 06	VEP	.96409126 00	CPE	.98447715 02	CPS	.77011908 02	D2	.50038698 00	D3	.17038548-01

1 DAYS 9 HRS. 32 MIN. 2.000 SEC. 23566660132020200000000000 J.D.= 2438607.33333333 JULY 30,1964 20 00 00.000
TFL 2 DAYS 3 HRS. 9 MIN. 52.127 SEC.

GEOCENTRIC EQUATORIAL COORDINATES

X	.27541534 06	Y	.15466632 06	Z	.37295100 05	DX	.70748863 00	DY	.60176250 00	DZ	.20578340 00
R	.31806635 06	DEC	.67337502 01	RA	.29317467 02	V	.95131753 00	PTH	.77667882 02	AZ	.61328860 02
R	.31806635 06	LAT	.67337502 01	LON	.14083826 03	VE	.22874594 02	PTE	.23284977 01	AZE	.27024437 03
XS	-.92763715 08	YS	.11030195 09	ZS	.47831739 08	DXS	-.23102084 02	DYS	-.16587726 02	DZS	-.71927901 01
XM	.35263871 06	YM	.13647531 06	ZM	.23907839 05	DXM	-.40874224 00	DYM	.85743459 00	DZM	.40991512 00
XT	.35263871 06	YT	.13647531 06	ZT	.23907839 05	DXT	-.40874224 00	DYT	.85743459 00	DZT	.40991512 00
RS	.15185356 09	VS	.29335902 02	RM	.37888144 06	VM	.10345505 01	RT	.37888144 06	VT	.10345505 01
GED	.67792136 01	ALT	.31168844 06	LOS	.24158455 03	RAS	.13006376 03	RAM	.21157023 02	LOM	.13267781 03
DUT	.35000000 02	DT	.19200000 04	DR	.92936686 00	SHA	.31498696 06	DES	.18359966 02	DEM	.36178308 01

HELIOCENTRIC EQUATORIAL COORDINATES

X	.93039130 08	Y	-.11014729 09	Z	-.47794444 08	DX	.23809572 02	DY	.17189489 02	DZ	.73985735 01
R	.15189803 09	LAT	-.18339576 02	LON	.31018709 03	V	.30283875 02	PTH	-.39564297 00	AZ	.75220654 02
XE	.92763715 08	YE	-.11030195 09	ZE	-.47831739 08	DXE	.23102084 02	DYE	.16587726 02	DZE	.71927901 01
XT	.93116353 08	YT	-.11016548 09	ZT	-.47807832 08	DXT	.22693341 02	DYT	.17445161 02	DZT	.76027052 01
LTE	-.18359966 02	LOE	.31006376 03	LTT	-.18336806 02	LOT	.31020586 03	RST	.15196274 09	VST	.29616253 02
EPS	.81901942 02	ESP	.11869406 00	SEP	.97979242 02	EPM	.13455842 03	EMP	.36738573 02	MEP	.87030011 01
MPS	.14353144 03	MSP	.15639313-01	SMP	.36450524 02	SEM	.10668117 03	EMS	.73181989 02	ESM	.13634040 00
RPM	.80458558 05	SPN	.80752946 02								
GCE	.10067977 03	GCT	.28174604 03	SIP	.14229582 03	CPT	.93599110 02	SIN	.92363495 02	D1	.64706735 00
REP	.31806635 06	VEP	.95131753 00	CPE	.98460706 02	CPS	.77016062 02	D2	.52711391 00	D3	.18895281-01

1 DAYS 10 HRS. 32 MIN. 2.000 SEC. 23566660312420200000000000 J.D.= 2438607.37500000 JULY 30,1964 21 00 00.000
TFL 2 DAYS 4 HRS. 9 MIN. 52.127 SEC.

GEOCENTRIC — EQUATORIAL COORDINATES

X	.27794499 06	Y	.15681905 06	Z	.38032064 05	DX	.69796108 00	DY	.59419481 00	DZ	.20363315 00
R	.32139083 06	DEC	.67960723 01	RA	.29432077 02	V	.93898008 00	PTH	.77760765 02	AZ	.61259363 02
R	.32139083 06	LAT	.67960723 01	LON	.12591180 03	VE	.23115401 02	PTE	.22751317 01	AZE	.27023743 03
XS	-.92846863 08	YS	.11024221 09	ZS	.47805832 08	DXS	-.23089535 02	DYS	-.16602818 02	DZS	-.71993231 01
XM	.35115026 06	YM	.13955538 06	ZM	.25382333 05	DXM	-.41816774 00	DYM	.85369540 00	DZM	.40923928 00
XT	.35115026 06	YT	.13955538 06	ZT	.25382333 05	DXT	-.41816774 00	DYT	.85369540 00	DZT	.40923928 00
RS	.15185283 09	VS	.29336162 02	RM	.37871687 06	VM	.10349574 01	RT	.37871687 06	VT	.10349574 01
GED	.68619484 01	ALT	.31501292 06	LOS	.22658407 03	RAS	.13010435 03	RAM	.21674040 02	LOM	.11815376 03
DUT	.35000000 02	DT	.19200000 04	DR	.91763797 00	SHA	.31834775 06	DES	.18349758 02	DEM	.38429530 01

HELIOCENTRIC — EQUATORIAL COORDINATES

X	.93124807 08	Y	-.11008539 09	Z	-.47767799 08	DX	.23787496 02	DY	.17197012 02	DZ	.74029562 01
R	.15189728 09	LAT	-.18329082 02	LON	.31022897 03	V	.30271867 02	PTH	-.39321399 00	AZ	.75205582 02
XE	.92846863 08	YE	-.11024221 09	ZE	-.47805832 08	DXE	.23089535 02	DYE	.16602818 02	DZE	.71993231 01
XT	.93198013 08	YT	-.11010265 09	ZT	-.47780450 08	DXT	.22671367 02	DYT	.17456513 02	DZT	.76085623 01
LTE	-.18349758 02	LOE	.31010435 03	LTT	-.18326440 02	LOT	.31024674 03	RST	.15195866 09	VST	.29607616 02
EPS	.81989127 02	ESP	.12033130 00	SEP	.97890790 02	EPM	.13442704 03	EMP	.37303952 02	MEP	.82690050 01
MPS	.14357612 03	MSP	.18504685-01	SMP	.36406797 02	SEM	.10615883 03	EMS	.73704009 02	ESM	.13723445 00
RPM	.76269665 05	SPN	.80852018 02								
GCE	.10066913 03	GCT	.28170447 03	SIP	.14227263 03	CPT	.93632451 02	SIN	.92328962 02	D1	.68262359 00
REP	.32139083 06	VEP	.93898008 00	CPE	.98473088 02	CPS	.77020220 02	D2	.55676639 00	D3	.21062537-01

1 DAYS 11 HRS. 32 MIN. 2.000 SEC. 2356666047302020000000C00 J.D.= 2438607.41666666 JULY 30,1964 22 00 00.000
TFL 2 DAYS 5 HRS. 9 MIN. 52.127 SEC.

GEOCENTRIC — EQUATORIAL COORDINATES

X	.28044137 06	Y	.15894458 06	Z	.38761219 05	DX	.68901668 00	DY	.58666610 00	DZ	.20144765 00
R	.32467394 06	DEC	.68566151 01	RA	.29543079 02	V	.92709344 00	PTH	.77871657 02	AZ	.61176301 02
R	.32467394 06	LAT	.68566159 01	LON	.11098175 03	VE	.23353403 02	PTE	.22243407 01	AZE	.27023057 03
XS	-.92929961 08	YS	.11018241 09	ZS	.47779903 08	DXS	-.23076975 02	DYS	-.16617902 02	DZS	-.72058529 01
XM	.34962792 06	YM	.14262182 06	ZM	.26854316 05	DXM	-.42756580 00	DYM	.84986977 00	DZM	.40852340 00
XT	.34962792 06	YT	.14262182 06	ZT	.26854316 05	DXT	-.42756580 00	DYT	.84986977 00	DZT	.40852340 00
RS	.15185210 09	VS	.29336423 02	RM	.37855227 06	VM	.10353659 01	RT	.37855227 06	VT	.10353659 01
GED	.69028929 01	ALT	.31829604 06	LOS	.21158358 03	RAS	.13014493 03	RAM	.22191755 02	LOM	.10363042 03
DUT	.35000000 02	DT	.19200000 04	DR	.90640020 00	SHA	.32166514 06	DES	.18339542 02	DEM	.40679513 01

HELIOCENTRIC — EQUATORIAL COORDINATES

X	.93210402 08	Y	-.11002347 09	Z	-.47741142 08	DX	.23765991 02	DY	.17204568 02	DZ	.74073005 01
R	.15189654 09	LAT	-.18318583 02	LON	.31027082 03	V	.30260330 02	PTH	-.39018565 00	AZ	.75190610 02
XE	.92929961 08	YE	-.11018241 09	ZE	-.47779903 08	DXE	.23076975 02	DYE	.16617902 02	DZE	.72058529 01
XT	.93279588 08	YT	-.11003579 09	ZT	-.47753049 08	DXT	.22649409 02	DYT	.17467772 02	DZT	.76143762 01
LTE	-.18339542 02	LOE	.31014493 03	LTT	-.18316068 02	LOT	.31028760 03	RST	.15195456 09	VST	.29598944 02
EPS	.82072337 02	ESP	.12114162 00	SEP	.97806326 02	EPM	.13431032 03	EMP	.37859128 02	MEP	.78305399 01
MPS	.14361C21 03	MSP	.15639313-01	SMP	.36373661 02	SEM	.10563603 03	EMS	.74226508 02	ESM	.13723445 00
RPM	.72076257 05	SPN	.80946727 02								
GCE	.10065892 03	GCT	.28165572 03	SIP	.14223087 03	CPT	.93666711 02	SIN	.92287371 02	D1	.72236113 00
REP	.32467394 06	VEP	.92709344 00	CPE	.98484851 02	CPS	.77024382 02	D2	.58987331 00	D3	.23614716-01

1 DAYS 12 HRS. 32 MIN. 2.000 SEC. 2356666065342020000000000 J.D.= 2438607.45833333 JULY 30,1964 23 00 00.000
TFL 2 DAYS 6 HRS. 9 MIN. 52.127 SEC.

GEOCENTRIC — EQUATORIAL COORDINATES

X	.28290666 06	Y	.16104307 06	Z	.39482434 05	DX	.68070435 00	DY	.57915846 00	DZ	.19921710 00
R	.32791753 06	DEC	.69153948 01	RA	.29650457 02	V	.91568028 00	PTH	.78004373 02	AZ	.61076432 02
R	.32791752 06	LAT	.69153948 01	LON	.96048056 02	VE	.23588780 02	PTE	.21760888 01	AZE	.27022373 03
XS	-.93013020 08	YS	.11012256 09	ZS	.47753949 08	DXS	-.23064402 02	DYS	-.16632980 02	DZS	-.72123799 01
XM	.34807181 06	YM	.14567434 06	ZM	.28323656 05	DXM	-.43693550 00	DYM	.84595782 00	DZM	.40776743 00
XT	.34807181 06	YT	.14567434 06	ZT	.28323656 05	DXT	-.43693550 00	DYT	.84595782 00	DZT	.40776743 00
RS	.15185137 09	VS	.29336685 02	RM	.37838767 06	VM	.10357758 01	RT	.37838767 06	VT	.10357758 01
GED	.69620607 01	ALT	.32153964 06	LOS	.19658310 03	RAS	.13018550 03	RAM	.22710193 02	LOM	.89107788 02
DUT	.35000000 02	DT	.19200000 04	DR	.89568502 00	SHA	.32494089 06	DES	.18329317 02	DEM	.42928071 01

HELIOCENTRIC — EQUATORIAL COORDINATES

X	.93295926 08	Y	-.10996151 09	Z	-.47714467 08	DX	.23745106 02	DY	.17212138 02	DZ	.74115969 01
R	.15189580 09	LAT	-.18308077 02	LON	.31031266 03	V	.30249289 02	PTH	-.38646320 00	AZ	.75175744 02
XE	.93013020 08	YE	-.11012256 09	ZE	-.47753949 08	DXE	.23064402 02	DYE	.16632980 02	DZE	.72123799 01
XT	.93361091 08	YT	-.10997688 09	ZT	-.47725626 08	DXT	.22627466 02	DYT	.17478938 02	DZT	.76201472 01
LTE	-.18329317 02	LOE	.31018550 03	LTT	-.18305689 02	LOT	.31032845 03	RST	.15195046 09	VST	.29590237 02
EPS	.82151557 02	ESP	.12254679 00	SEP	.97725870 02	EPM	.13420946 03	EMP	.38402919 02	MEP	.73876046 01
MPS	.14363252 03	MSP	.13988227-01	SMP	.36352295 02	SEM	.10511277 03	EMS	.74749482 02	ESM	.13741256 00
RPM	.67876457 05	SPN	.81037083 02								
GCE	.10064912 03	GCT	.28159853 03	SIP	.14216782 03	CPT	.93702274 02	SIN	.92237569 02	D1	.76708499 00
REP	.32791753 06	VEP	.91568028 00	CPE	.98495980 02	CPS	.77028549 02	D2	.62710029 00	D3	.26650182-01

1 DAYS 13 HRS. 32 MIN. 2.000 SEC. 2356666103402020000000C00 J.D.= 2438607.50000000 JULY 31,1964 00 00 00.000
TFL 2 DAYS 7 HRS. 9 MIN. 52.127 SEC.

GEOCENTRIC — EQUATORIAL COORDINATES

X	.28534327 06	Y	.16311453 06	Z	.40195518 05	DX	.67309006 00	DY	.57165062 00	DZ	.19692926 00
R	.33112356 06	DEC	.69724064 01	RA	.29754147 02	V	.90477388 00	PTH	.78163691 02	AZ	.60955384 02
R	.33112355 06	LAT	.69724064 01	LON	.81110628 02	VE	.23821735 02	PTE	.21303718 01	AZE	.27021685 03
XS	-.93096028 08	YS	.11006265 09	ZS	.47727973 08	DXS	-.23051817 02	DYS	-.16648050 02	DZS	-.72189038 01
XM	.34648203 06	YM	.14871262 06	ZM	.29790198 05	DXM	-.44627570 00	DYM	.84195970 00	DZM	.40697135 00
XT	.34648203 06	YT	.14871262 06	ZT	.29790198 05	DXT	-.44627570 00	DYT	.84195970 00	DZT	.40697135 00
RS	.15185064 09	VS	.29336946 02	RM	.37822307 06	VM	.10361871 01	RT	.37822307 06	VT	.10361871 01
GED	.70194494 01	ALT	.32474567 06	LOS	.18158255 03	RAS	.13022607 03	RAM	.23229364 02	LOM	.74585845 02
DUT	.35000000 02	DT	.19200000 04	DR	.88553624 00	SHA	.32817688 06	DES	.18319083 02	DEM	.45174981 01

HELIOCENTRIC — EQUATORIAL COORDINATES

X	.93381371 08	Y	-.10989954 09	Z	-.47687777 08	DX	.23724907 02	DY	.17219701 02	DZ	.74158330 01
R	.15189507 09	LAT	-.18297563 02	LON	.31035447 03	V	.30238781 02	PTH	-.38193222 00	AZ	.75160988 02
XE	.93096028 08	YE	-.11006265 09	ZE	-.47727973 08	DXE	.23051817 02	DYE	.16648050 02	DZE	.72189038 01
XT	.93442510 08	YT	-.10991394 09	ZT	-.47698183 08	DXT	.22605541 02	DYT	.17490010 02	DZT	.76258751 01
LTE	-.18319083 02	LOE	.31022607 03	LTT	-.18295303 02	LOT	.31036928 03	RST	.15194635 09	VST	.29581496 02
EPS	.82226737 02	ESP	.12393603 00	SEP	.97649470 02	EPM	.13412601 03	EMP	.38933832 02	MEP	.69401497 01
MPS	.14364157 03	MSP	.15639313-01	SMP	.36344196 02	SEM	.10458903 03	EMS	.75272939 02	ESM	.13794551 00
RPM	.63668147 05	SPN	.81123055 02								
GCE	.10063971 03	GCT	.28153134 03	SIP	.142C8C02 03	CPT	.93739634 02	SIN	.92178093 02	D1	.81782396 00
REP	.33112356 06	VEP	.90477388 00	CPE	.98506448 02	CPS	.77032720 02	D2	.66929813 00	D3	.30301315-01

1 DAYS 14 HRS. 32 MIN. 2.000 SEC. 2356666121442020000000000 J.D.= 2438607.54166666 JULY 31,1964 01 00 00.000
TFL 2 DAYS 8 HRS. 9 MIN. 52.127 SEC.

GEOCENTRIC — EQUATORIAL COORDINATES

X	.28775385 06	Y	.16515892 06	Z	.40900239 05	DX	.66626292 00	DY	.56411685 00	DZ	.19456880 00
R	.33429414 06	DEC	.70276371 01	RA	.29854056 02	V	.89442223 00	PTH	.78355716 02	AZ	.60807104 02
R	.33429413 06	LAT	.70276371 01	LON	.66169472 02	VE	.24052497 02	PTE	.20872264 01	AZE	.27020989 03
XS	-.93178993 08	YS	.11000269 09	ZS	.47701973 08	DXS	-.23039221 02	DYS	-.16663114 02	DZS	-.72254246 01
XM	.34485867 06	YM	.15173635 06	ZM	.31253802 05	DXM	-.45558560 00	DYM	.83787561 00	DZM	.40613513 00
XT	.34485867 06	YT	.15173635 06	ZT	.31253802 05	DXT	-.45558560 00	DYT	.83787561 00	DZT	.40613513 00
RS	.15184991 09	VS	.29337209 02	RM	.37805849 06	VM	.10366000 01	RT	.37805849 06	VT	.10366000 01
GED	.70750451 01	ALT	.32791626 06	LOS	.16658205 03	RAS	.13026663 03	RAM	.23749292 02	LOM	.60064708 02
DUT	.35000000 02	DT	.19200000 04	DR	.87601463 00	SHA	.33137510 06	DES	.18308841 02	DEM	.47420099 01

HELIOCENTRIC — EQUATORIAL COORDINATES

X	.93466746 08	Y	-.10983753 09	Z	-.47661C73 08	DX	.23705484 02	DY	.17227230 02	DZ	.74199934 01
R	.15189435 09	LAT	-.18287044 02	LON	.31039627 03	V	.30228856 02	PTH	-.37643819 00	AZ	.75146349 02
XE	.93178993 08	YE	-.11000269 09	ZE	-.47701973 08	DXE	.23039221 02	DYE	.16663114 02	DZE	.72254246 01
XT	.93523851 08	YT	-.10985095 09	ZT	-.47670719 08	DXT	.22583635 02	DYT	.17500989 02	DZT	.76315597 01
LTE	-.18308841 02	LOE	.31026663 03	LTT	-.18284910 02	LOT	.31041009 03	RST	.15194223 09	VST	.29572722 02
EPS	.82297778 02	ESP	.12472294 00	SEP	.97577223 02	EPM	.13406207 03	EMP	.39449852 02	MEP	.64880654 01
MPS	.14363533 03	MSP	.15639313-01	SMP	.36351378 02	SEM	.10406483 03	EMS	.75796881 02	ESM	.13829968 00
RPM	.59448962 05	SPN	.81204566 02								
GCE	.10063069 03	GCT	.28145209 03	SIP	.14196293 03	CPT	.93779394 02	SIN	.92106997 02	D1	.87591404 00
REP	.33429414 06	VEP	.89442223 00	CPE	.98516224 02	CPS	.77036893 02	D2	.71757124 00	D3	.34749674-01

1 DAYS 15 HRS. 32 MIN. 2.000 SEC. 2356666137502020000000C00 J.D.= 2438607.58333334 JULY 31,1964 02 00 00.000
TFL 2 DAYS 9 HRS. 9 MIN. 52.127 SEC.

GEOCENTRIC — EQUATORIAL COORDINATES

X	.29014145 06	Y	.16717611 06	Z	.41596305 05	DX	.66034385 00	DY	.55652490 00	DZ	.19211601 00
R	.33743171 06	DEC	.70810509 01	RA	.29950040 02	V	.88469345 00	PTH	.78588337 00	AZ	.60622980 02
R	.33743171 06	LAT	.70810509 01	LON	.51224392 02	VE	.24281341 02	PTE	.20467421 01	AZE	.27020274 03
XS	-.93261913 08	YS	.10994267 09	ZS	.47675950 08	DXS	-.23026613 02	DYS	-.16678170 02	DZS	-.72319426 01
XM	.34320185 06	YM	.15474523 06	ZM	.32714325 05	DXM	-.46486416 00	DYM	.83370572 00	DZM	.40525876 00
XT	.34320185 06	YT	.15474523 06	ZT	.32714325 05	DXT	-.46486416 00	DYT	.83370572 00	DZT	.40525876 00
RS	.15184917 09	VS	.29337472 02	RM	.37789392 06	VM	.10370143 01	RT	.37789392 06	VT	.10370143 01
GED	.71288118 01	ALT	.33105383 06	LOS	.15158155 03	RAS	.13030720 03	RAM	.24269992 02	LOM	.45544342 02
DUT	.35000000 02	DT	.19200000 04	DR	.86720389 00	SHA	.33453780 06	DES	.18298590 02	DEM	.49663192 01

HELIOCENTRIC — EQUATORIAL COORDINATES

X	.93552054 08	Y	-.10977550 09	Z	-.47634353 08	DX	.23686956 02	DY	.17234695 02	DZ	.74240585 01
R	.15189364 09	LAT	-.18276518 02	LON	.31043805 03	V	.30219584 02	PTH	-.36977875 00	AZ	.75131837 02
XE	.93261913 08	YE	-.10994267 09	ZE	-.47675950 08	DXE	.23026613 02	DYE	.16678170 02	DZE	.72319426 01
XT	.93605114 08	YT	-.10978793 09	ZT	-.47643235 08	DXT	.22561748 02	DYT	.17511876 02	DZT	.76372012 01
LTE	-.18298590 02	LOE	.31030720 03	LTT	-.18274509 02	LOT	.31045089 03	RST	.15193809 09	VST	.29563916 02
EPS	.82364536 02	ESP	.12647557 00	SEP	.97509269 02	EPM	.13402038 03	EMP	.39948386 02	MEP	.60312232 01
MPS	.14361121 03	MSP	.27453512-18	SMP	.36376433 02	SEM	.10354015 03	EMS	.76321299 02	ESM	.13829968 00
RPM	.55216140 05	SPN	.81281489 02								
GCE	.10062203 03	GCT	.28135815 03	SIP	.14181C57 03	CPT	.93822374 02	SIN	.92021732 02	D1	.94312485 00
REP	.33743171 06	VEP	.88469345 00	CPE	.98525263 02	CPS	.77041072 02	D2	.77338328 00	D3	.40250231-01

1 DAYS 16 HRS. 32 MIN. 2.000 SEC. 2356666155542020000000000 J.D.= 2438607.62500000 JULY 31,1964 03 00 00.000
TFL 2 DAYS 10 HRS. 9 MIN. 52.127 SEC.

GEOCENTRIC — EQUATORIAL COORDINATES

X	.29250961 06	Y	.16916579 06	Z	.42283335 05	DX	.65549936 00	DY	.54883336 00	DZ	.18954510 00
R	.34053900 06	DEC	.71325915 01	RA	.30041891 02	V	.87568533 00	PTH	.78871977 02	AZ	.60390320 02
R	.34053899 06	LAT	.71325923 01	LON	.36275186 02	VE	.24508598 02	PTE	.20090830 01	AZE	.27019534 03
XS	-.93344787 08	YS	.10988261 09	ZS	.47649902 08	DXS	-.23013993 02	DYS	-.16693221 02	DZS	-.72384576 01
XM	.34151167 06	YM	.15773894 06	ZM	.34171620 05	DXM	-.47411037 00	DYM	.82945022 00	DZM	.40434222 00
XT	.34151167 06	YT	.15773894 06	ZT	.34171620 05	DXT	-.47411037 00	DYT	.82945022 00	DZT	.40434222 00
RS	.15184844 09	VS	.29337736 02	RM	.37772939 06	VM	.10374300 01	RT	.37772939 06	VT	.10374300 01
GED	.71806937 01	ALT	.33416113 06	LOS	.13658104 03	RAS	.13034775 03	RAM	.24791482 02	LOM	.31024769 02
DUT	.35000000 02	DT	.19200000 04	DR	.85922106 00	SHA	.33766752 06	DES	.18288331 02	DEM	.51904100 01

HELIOCENTRIC — EQUATORIAL COORDINATES

X	.93637296 08	Y	-.10971344 09	Z	-.47607619 08	DX	.23669492 02	DY	.17242054 02	DZ	.74280027 01
R	.15189295 09	LAT	-.18265985 02	LON	.31047981 03	V	.30211066 02	PTH	-.36168498 00	AZ	.75117464 02
XE	.93344787 08	YE	-.10988261 09	ZE	-.47649902 08	DXE	.23013993 02	DYE	.16693221 02	DZE	.72384576 01
XT	.93686298 08	YT	-.10972487 09	ZT	-.47615730 08	DXT	.22539882 02	DYT	.17522671 02	DZT	.76427998 01
LTE	-.18288331 02	LOE	.31034775 03	LTT	-.18264101 02	LOT	.31049167 03	RST	.15193395 09	VST	.29555079 02
EPS	.82426801 02	ESP	.12743884 00	SEP	.97445826 02	EPM	.13400471 03	EMP	.40425873 02	MEP	.55694013 01
MPS	.14356563 03	MSP	.27453512-18	SMP	.36422950 02	SEM	.10301500 03	EMS	.76846206 02	ESM	.13882922 00
RPM	.50966413 05	SPN	.81353638 02								
GCE	.10061373 03	GCT	.28124599 03	SIP	.14161479 03	CPT	.93869640 02	SIN	.91918799 02	D1	.10218531 01
REP	.34053900 06	VEP	.87568533 00	CPE	.98533500 02	CPS	.77045255 02	D2	.83871592 00	D3	.47170306-01

1 DAYS 17 HRS. 32 MIN. 2.000 SEC. 2356666173602020000000C00 J.D.= 2438607.66666666 JULY 31,1964 04 00 00.000
TFL 2 DAYS 11 HRS. 9 MIN. 52.127 SEC.

GEOCENTRIC — EQUATORIAL COORDINATES

X	.29486259 06	Y	.17112753 06	Z	.42960848 05	DX	.65196283 00	DY	.54098728 00	DZ	.18682160 00
R	.34361928 06	DEC	.71821752 01	RA	.30129319 02	V	.86753967 00	PTH	.79220676 02	AZ	.60089666 02
R	.34361928 06	LAT	.71821752 01	LON	.21321538 02	VE	.24734682 02	PTE	.19745120 01	AZE	.27018752 03
XS	-.93427617 08	YS	.10982248 09	ZS	.47623831 08	DXS	-.23001360 02	DYS	-.16708264 02	DZS	-.72449698 01
XM	.33978828 06	YM	.16071717 06	ZM	.35625545 05	DXM	-.48332322 00	DYM	.82510930 00	DZM	.40338548 00
XT	.33978828 06	YT	.16071717 06	ZT	.35625545 05	DXT	-.48332322 00	DYT	.82510930 00	DZT	.40338548 00
RS	.15184771 09	VS	.29338000 02	RM	.37756491 06	VM	.10378471 01	RT	.37756491 06	VT	.10378471 01
GED	.72306038 01	ALT	.33724141 06	LOS	.12158052 03	RAS	.13038831 03	RAM	.25313779 02	LOM	.16505994 02
DUT	.35000000 02	DT	.19200000 04	DR	.85223179 00	SHA	.34076722 06	DES	.18278062 02	DEM	.54142601 01

HELIOCENTRIC — EQUATORIAL COORDINATES

X	.93722479 08	Y	-.10965135 09	Z	-.47580871 08	DX	.23653323 02	DY	.17249251 02	DZ	.74317914 01
R	.15189227 09	LAT	-.18255443 02	LON	.31052156 03	V	.30203441 02	PTH	-.35177950 00	AZ	.75103249 02
XE	.93427617 08	YE	-.10982248 09	ZE	-.47623831 08	DXE	.23001360 02	DYE	.16708264 02	DZE	.72449698 01
XT	.93767405 08	YT	-.10966176 09	ZT	-.47588206 08	DXT	.22518037 02	DYT	.17533373 02	DZT	.76483552 01
LTE	-.18278062 02	LOE	.31038831 03	LTT	-.18253688 02	LOT	.31053244 03	RST	.15192980 09	VST	.29546209 02
EPS	.82484268 02	ESP	.12877532 00	SEP	.97387188 02	EPM	.13402024 03	EMP	.40877419 02	MEP	.51023418 01
MPS	.14349366 03	MSP	.13988227-01	SMP	.36495861 02	SEM	.10248938 03	EMS	.77371595 02	ESM	.13882922 00
RPM	.46695822 05	SPN	.81420726 02								
GCE	.10060577 03	GCT	.28111082 03	SIP	.14136432 03	CPT	.93922669 02	SIN	.91793334 02	D1	.11154309 01
REP	.34361928 06	VEP	.86753967 00	CPE	.98540857 02	CPS	.77049442 02	D2	.91632518 00	D3	.56055842-01

1 DAYS 18 HRS. 32 MIN. 2.000 SEC. 2356666211642020000000000 J.D.= 2438607.70833333 JULY 31,1964 05 00 00.000
TFL 2 DAYS 12 HRS. 9 MIN. 52.127 SEC.

GEOCENTRIC — EQUATORIAL COORDINATES

X	.29720570 06	Y	.17306063 06	Z	.43628215 05	DX	.65007001 00	DY	.53291134 00	DZ	.18389813 00
R	.34667655 06	DEC	.72296749 01	RA	.30211917 02	V	.86046733 00	PTH	.79653840 02	AZ	.59689594 02
R	.34667654 06	LAT	.72296749 01	LON	.63630677 01	VE	.24960135 02	PTE	.19434518 01	AZE	.27017913 03
XS	-.93510403 08	YS	.10976230 09	ZS	.47597737 08	DXS	-.22988717 02	DYS	-.16723300 02	DZS	-.72514790 01
XM	.33803178 06	YM	.16367963 06	ZM	.37075952 05	DXM	-.49250170 00	DYM	.82068316 00	DZM	.40238855 00
XT	.33803178 06	YT	.16367963 06	ZT	.37075952 05	DXT	-.49250170 00	DYT	.82068316 00	DZT	.40238855 00
RS	.15184697 09	VS	.29338265 02	RM	.37740049 06	VM	.10382655 01	RT	.37740049 06	VT	.10382655 01
GED	.72784170 01	ALT	.34029868 06	LOS	.10658C01 03	RAS	.13042886 03	RAM	.25836903 02	LOM	.19880521 01
DUT	.35000000 02	DT	.19200000 04	DR	.84647671 C0	SHA	.34384051 06	DES	.18267784 02	DEM	.56378515 01

HELIOCENTRIC — EQUATORIAL COORDINATES

X	.93807608 08	Y	-.10958924 09	Z	-.47554109 08	DX	.23638786 02	DY	.17256211 02	DZ	.74353770 01
R	.15189161 09	LAT	-.18244896 02	LON	.31056329 03	V	.30196918 02	PTH	-.33952956 00	AZ	.75089216 02
XE	.93510403 08	YE	-.10976230 09	ZE	-.47597737 08	DXE	.22988717 02	DYE	.16723300 02	DZE	.72514790 01
XT	.93848434 08	YT	-.10959862 09	ZT	-.47560661 08	DXT	.22496215 02	DYT	.17543983 02	DZT	.76538675 01
LTE	-.18267784 02	LOE	.31042886 03	LTT	-.18243267 02	LOT	.31057318 03	RST	.15192565 09	VST	.29537310 02
EPS	.82536519 02	ESP	.12972151 00	SEP	.97333776 02	EPM	.13407436 03	EMP	.41296060 02	MEP	.46295607 01
MPS	.14338824 03	MSP	.13988227-01	SMP	.36602218 02	SEM	.10196329 03	EMS	.77897470 02	ESM	.13882922 00
RPM	.42399342 05	SPN	.81482358 02								
GCE	.10059814 03	GCT	.28094591 03	SIP	.14104301 03	CPT	.93983527 02	SIN	.91638304 02	D1	.12286425 01
REP	.34667655 06	VEP	.86046733 00	CPE	.98547216 02	CPS	.77053636 02	D2	.10101683 01	D3	.67748769-01

1 DAYS 19 HRS. 32 MIN. 2.000 SEC. 2356666227702020000000000 J.D.= 2438607.75000000 JULY 31,1964 06 00 00.000
TFL 2 DAYS 13 HRS. 9 MIN. 52.127 SEC.

GEOCENTRIC — EQUATORIAL COORDINATES

X	.29954566 06	Y	.17496408 06	Z	.44284596 05	DX	.65031997 00	DY	.52449829 00	DZ	.18070771 00
R	.34971582 06	DEC	.72749095 01	RA	.30289121 02	V	.85479225 00	PTH	.80199046 02	AZ	.59135949 02
R	.34971581 06	LAT	.72749095 01	LON	.3513992C 03	VE	.25185688 02	PTE	.19165716 01	AZE	.27016991 03
XS	-.93593138 08	YS	.10970207 09	ZS	.47571620 08	DXS	-.22976060 02	DYS	-.16738328 02	DZS	-.72579850 01
XM	.33624231 06	YM	.16662600 06	ZM	.38522696 05	DXM	-.50164480 00	DYM	.81617203 00	DZM	.40135140 00
XT	.33624231 06	YT	.16662600 06	ZT	.38522696 05	DXT	-.50164480 00	DYT	.81617203 00	DZT	.40135140 00
RS	.15184623 09	VS	.29338529 02	RM	.37723614 06	VM	.10386853 01	RT	.37723614 06	VT	.10386853 01
GED	.73239499 01	ALT	.34333796 06	LOS	.9157948C 02	RAS	.13046940 03	RAM	.26360868 02	LOM	.34747095 03
DUT	.35000000 02	DT	.24000C00 03	DR	.84231663 C0	SHA	.34689188 06	DES	.18257498 02	DEM	.58611628 01

HELIOCENTRIC — EQUATORIAL COORDINATES

X	.93892684 08	Y	-.10952711 09	Z	-.47527335 08	DX	.23626380 02	DY	.17262827 02	DZ	.74386927 01
R	.15189098 09	LAT	-.18234341 02	LON	.31060500 03	V	.30191806 02	PTH	-.32415223 00	AZ	.75075400 02
XE	.93593138 08	YE	-.10970207 09	ZE	-.47571620 08	DXE	.22976060 02	DYE	.16738328 02	DZE	.72579850 01
XT	.93929381 08	YT	-.10953545 09	ZT	-.47533097 08	DXT	.22474416 02	DYT	.17554501 02	DZT	.76593365 01
LTE	-.18257498 02	LOE	.31046940 03	LTT	-.18232840 02	LOT	.31061391 03	RST	.15192148 09	VST	.29528381 02
EPS	.82582968 02	ESP	.13084791 00	SEP	.97286175 02	EPM	.13417793 03	EMP	.41671513 02	MEP	.41505451 01
MPS	.14323893 03	MSP	.98911702-02	SMP	.36752475 02	SEM	.10143672 03	EMS	.78423832 02	ESM	.13935676 00
RPM	.38070555 05	SPN	.81537969 02								
GCE	.10059083 03	GCT	.28074153 03	SIP	.14062687 03	CPT	.94055260 02	SIN	.91443200 02	D1	.13686203 01
REP	.34971582 06	VEP	.85479225 00	CPE	.98552424 02	CPS	.77057834 02	D2	.11261467 01	D3	.83606271-01

SELENOCENTRIC — EQUATORIAL COORDINATES

X	-.36696648 05	Y	.83380871 04	Z	.57618991 04	DX	.11519648 01	DY	-.29167374 00	DZ	-.22064369 00
R	.38070555 05	DEC	.87050495 01	RA	.16719879 03	V	.12086273 01	PTH	-.87716411 02	AZ	.14269787 03
R	.38070552 05	LAT	.44277623 01	LON	.31283843 03	VP	.12093925 01	PTP	-.86939368 02	AZP	.24851000 03
LTS	.93672287 00	LNS	.27620483 03	LTE	.60749665 01	LNE	.35466258 03				
ALT	.36335555 05	SHA	-.22779867 05	ALP	.39570814 01	DR	-.12076675 01	DP	.72476656-04	ASD	.26120598 01
HGE	.27741703 03	SVL	.90190084-01	HNG	.14323902 03	SIA	.13156587 03				

1 DAYS 20 HRS. 32 MIN. 2.000 SEC. 2356666245742020000000000 J.D.= 2438607.79166666 JULY 31,1964 07 00 00.000
TFL 2 DAYS 14 HRS. 9 MIN. 52.127 SEC.

GEOCENTRIC — EQUATORIAL COORDINATES

X	.30189148 06	Y	.17683643 06	Z	.44928874 05	DX	.65348665 00	DY	.51558823 00	DZ	.17715202 00
R	.35274380 06	DEC	.73176247 01	RA	.30360130 02	V	.85103400 00	PTH	.80896907 02	AZ	.58327045 02
R	.35274380 06	LAT	.73176247 01	LON	.33642915 03	VE	.25412387 02	PTE	.18949531 01	AZE	.27015948 03
XS	-.93675832 08	YS	.10964178 09	ZS	.47545478 08	DXS	-.22963393 02	DYS	-.16753351 02	DZS	-.72644881 01
XM	.33441998 06	YM	.16955598 06	ZM	.39965637 05	DXM	-.51075156 00	DYM	.81157612 00	DZM	.40027404 00
XT	.33441998 06	YT	.16955598 06	ZT	.39965637 05	DXT	-.51075156 00	DYT	.81157612 00	DZT	.40027404 00
RS	.15184550 09	VS	.29338796 02	RM	.37707188 06	VM	.10391065 01	RT	.37707188 06	VT	.10391065 01
GED	.73669466 01	ALT	.34636594 06	LOS	.76578955 02	RAS	.13050994 03	RAM	.26885695 02	LOM	.33295470 03
DUT	.35000000 02	DT	.48000000 03	DR	.84031546 00	SHA	.34992730 06	DES	.18247204 02	DEM	.60841762 01

HELIOCENTRIC — EQUATORIAL COORDINATES

X	.93977723 08	Y	-.10946495 09	Z	-.47500549 08	DX	.23616879 02	DY	.17268939 02	DZ	.74416402 01
R	.15189039 09	LAT	-.18223777 02	LON	.31064671 03	V	.30188595 02	PTH	-.30445226 00	AZ	.75061850 02
XE	.93675832 08	YE	-.10964178 09	ZE	-.47545478 08	DXE	.22963393 02	DYE	.16753351 02	DZE	.72644881 01
XT	.94010252 08	YT	-.10947223 09	ZT	-.47505512 08	DXT	.22452641 02	DYT	.17564927 02	DZT	.76647622 01
LTE	-.18247204 02	LOE	.31050994 03	LTT	-.18222404 02	LOT	.31065463 03	RST	.15191731 09	VST	.29519423 02
EPS	.82622775 02	ESP	.13270400 00	SEP	.97245222 02	EPM	.13434754 03	EMP	.41988000 02	MEP	.36644387 01
MPS	.14302960 03	MSP	.98911702-02	SMP	.36962754 02	SEM	.10090967 03	EMS	.78950685 02	ESM	.13988231 00
RPM	.33700774 05	SPN	.81586748 02								
GCE	.10058382 03	GCT	.28048294 03	SIP	.14007856 03	CPT	.94142531 02	SIN	.91191497 02	D1	.15465258 01
REP	.35274380 06	VEP	.85103400 00	CPE	.98556259 02	CPS	.77062037 02	D2	.12734992 01	D3	.10594151 00

SELENOCENTRIC — EQUATORIAL COORDINATES

X	-.32528503 05	Y	.72804507 04	Z	.49632370 04	DX	.11642382 01	DY	-.29598789 00	DZ	-.22312202 00
R	.33700774 05	DEC	.84689666 01	RA	.16738411 03	V	.12218195 01	PTH	-.87381160 02	AZ	.14175774 03
R	.33700771 05	LAT	.42832082 01	LON	.31255185 03	VP	.12215310 01	PTP	-.87695763 02	AZP	.23718593 03
LTS	.93754078 00	LNS	.27569590 03	LTE	.60460074 01	LNE	.35468368 03				
ALT	.31965774 05	SHA	-.20264131 05	ALP	.37315782 01	DR	-.12205434 01	DP	.94912533-04	ASD	.29510327 01
HGE	.27737722 03	SVL	-.60666592-01	HNG	.14302964 03	SIA	.13139651 03				

1 DAYS 21 HRS. 32 MIN. 2.000 SEC. 2356666264C020200000000 J.D.= 2438607.83333333 JULY 31,1964 08 00 00.000
TFL 2 DAYS 15 HRS. 9 MIN. 52.127 SEC.

GEOCENTRIC — EQUATORIAL COORDINATES

X	.30425574 06	Y	.17867544 06	Z	.45559479 05	DX	.66083973 00	DY	.50592980 00	DZ	.17308061 00
R	.35576978 06	DEC	.73574378 01	RA	.30423760 02	V	.85007706 00	PTH	.81809615 02	AZ	.57047776 02
R	.35576978 06	LAT	.73574378 01	LON	.32145171 03	VE	.25641811 02	PTE	.18804313 01	AZE	.27014727 03
XS	-.93758477 08	YS	.10958144 09	ZS	.47519313 08	DXS	-.22950713 02	DYS	-.16768366 02	DZS	-.72709884 01
XM	.33256494 06	YM	.17246926 06	ZM	.41404626 05	DXM	-.51982092 00	DYM	.80689567 00	DZM	.39915648 00
XT	.33256494 06	YT	.17246926 06	ZT	.41404626 05	DXT	-.51982092 00	DYT	.80689567 00	DZT	.39915648 00
RS	.15184475 09	VS	.29339062 02	RM	.37690772 06	VM	.10395289 01	RT	.37690772 06	VT	.10395289 01
GED	.74070222 01	ALT	.34939192 06	LOS	.61578427 02	RAS	.13055048 03	RAM	.27411400 02	LOM	.31843935 03
DUT	.35000000 02	DT	.48000000 03	DR	.84140640 00	SHA	.35295496 06	DES	.18236900 02	DEM	.63068711 01

HELIOCENTRIC — EQUATORIAL COORDINATES

X	.94062732 08	Y	-.10940277 09	Z	-.47473754 08	DX	.23611552 02	DY	.17274296 02	DZ	.74440690 01
R	.15188983 09	LAT	-.18213204 02	LON	.31068841 03	V	.30188091 02	PTH	-.27848645 00	AZ	.75048632 02
XE	.93758477 08	YE	-.10958144 09	ZE	-.47519313 08	DXE	.22950713 02	DYE	.16768366 02	DZE	.72709884 01
XT	.94091042 08	YT	-.10940897 09	ZT	-.47477908 08	DXT	.22430892 02	DYT	.17575262 02	DZT	.76701449 01
LTE	-.18236900 02	LOE	.31055047 03	LTT	-.18211962 02	LOT	.31069532 03	RST	.15191313 09	VST	.29510436 02
EPS	.82654708 02	ESP	.13288819 00	SEP	.97212148 02	EPM	.13461013 03	EMP	.42219804 02	MEP	.31700421 01
MPS	.14273379 03	MSP	.27453512-18	SMP	.37259520 02	SEM	.10038214 03	EMS	.79478025 02	ESM	.13988231 00
RPM	.29277805 05	SPN	.81627493 02								
GCE	.10057707 03	GCT	.28014667 03	SIP	.13933646 03	CPT	.94252907 02	SIN	.90855575 02	D1	.17809270 01
REP	.35576978 06	VEP	.85007706 00	CPE	.98558389 02	CPS	.77066246 02	D2	.14676053 01	D3	.13898536 00

SELENOCENTRIC — EQUATORIAL COORDINATES

X	-.28309192 05	Y	.62061829 04	Z	.41548527 04	DX	.11806607 01	DY	-.30096588 00	DZ	-.22607587 00
R	.29277805 05	DEC	.81584635 01	RA	.16763475 03	V	.12392136 01	PTH	-.86969321 02	AZ	.14108713 03
R	.29277802 05	LAT	.40959423 01	LON	.31235437 03	VP	.12380280 01	PTP	-.88295552 02	AZP	.21394404 03
LTS	.93835870 00	LNS	.27518695 03	LTE	.60164258 01	LNE	.35470520 03				
ALT	.27542805 05	SHA	-.17725551 05	ALP	.34412585 01	DR	-.12374804 01	DP	.12821575-03	ASD	.33973318 01
HGE	.27734529 03	SVL	-.26061013 00	HNG	.14273456 03	SIA	.13121280 03				

1 DAYS 22 HRS. 32 MIN. 2.000 SEC. 2356666302C4202000000000 J.D.= 2438607.87500000 JULY 31,1964 09 00 00.000
TFL 2 DAYS 16 HRS. 9 MIN. 52.127 SEC.

GEOCENTRIC — EQUATORIAL COORDINATES

X	.30665716 06	Y	.18047774 06	Z	.46174154 05	DX	.67462447 00	DY	.49510014 00	DZ	.16825085 00
R	.35880757 06	DEC	.73937719 01	RA	.30478196 02	V	.85355180 00	PTH	.83036599 02	AZ	.54755004 02
R	.35880757 06	LAT	.73937728 01	LON	.30646508 03	VE	.25876536 02	PTE	.18763264 01	AZE	.27013229 03
XS	-.93841081 08	YS	.10952105 09	ZS	.47493125 08	DXS	-.22938021 02	DYS	-.16783374 02	DZS	-.72774854 01
XM	.33067732 06	YM	.17536553 06	ZM	.42839519 05	DXM	-.52885193 00	DYM	.80213095 00	DZM	.39799871 00
XT	.33067732 06	YT	.17536553 06	ZT	.42839519 05	DXT	-.52885193 00	DYT	.80213095 00	DZT	.39799871 00
RS	.15184402 09	VS	.29339329 02	RM	.37674365 06	VM	.10399526 01	RT	.37674365 06	VT	.10399526 01
GED	.74435965 01	ALT	.35242973 06	LOS	.46577892 02	RAS	.13059101 03	RAM	.27938000 02	LOM	.30392488 03
DUT	.35000000 02	DT	.48000000 03	DR	.84725584 00	SHA	.35598702 06	DES	.18226587 02	DEM	.65292262 01

HELIOCENTRIC — EQUATORIAL COORDINATES

X	.94147738 08	Y	-.10934057 09	Z	-.47446951 08	DX	.23612646 02	DY	.17278474 02	DZ	.74457363 01
R	.15188933 09	LAT	-.18202623 02	LON	.31073011 03	V	.30191749 02	PTH	-.24286957 00	AZ	.75035847 02
XE	.93841081 08	YE	-.10952105 09	ZE	-.47493125 08	DXE	.22938021 02	DYE	.16783374 02	DZE	.72774854 01
XT	.94171759 08	YT	-.10934568 09	ZT	-.47450286 08	DXT	.22409170 02	DYT	.17585505 02	DZT	.76754842 01
LTE	-.18226587 02	LOE	.31059101 03	LTT	-.18201515 02	LOT	.31073601 03	RST	.15190895 09	VST	.29501422 02
EPS	.82676873 02	ESP	.13417039 00	SEP	.97188838 02	EPM	.13501262 03	EMP	.42321838 02	MEP	.26655208 01
MPS	.14230473 03	MSP	.27453512-18	SMP	.37689551 02	SEM	.99854144 02	EMS	.80005854 02	ESM	.13988231 00
RPM	.24783506 05	SPN	.81658355 02								
GCE	.10057053 03	GCT	.27969258 03	SIP	.13829038 03	CPT	.94399649 02	SIN	.90385303 02	D1	.21053525 01
REP	.35880757 06	VEP	.85355180 00	CPE	.98558301 02	CPS	.77070465 02	D2	.17362648 01	D3	.19123863 00

SELENOCENTRIC — EQUATORIAL COORDINATES

X	-.24020153 05	Y	.51122044 04	Z	.33346352 04	DX	.12034764 01	DY	-.10703081 00	DZ	-.22974786 00
R	.24783506 05	DEC	.77326346 01	RA	.16798502 03	V	.12630944 01	PTH	-.86437491 02	AZ	.14063452 03
R	.24783502 05	LAT	.38419634 01	LON	.31229364 03	VP	.12611723 01	PTP	-.88356459 02	AZP	.17487676 03
LTS	.93917662 00	LNS	.27467801 03	LTE	.59862262 01	LNE	.35472715 03				
ALT	.23048506 05	SHA	-.15152207 05	ALP	.30540350 01	DR	-.12606536 01	DP	.18144545-03	ASD	.40143454 01
HGE	.27732312 03	SVL	-.53682042 00	HNG	.14230798 03	SIA	.13099827 03				

1 DAYS 23 HRS. 32 MIN. 2.000 SEC. 2356666320102020000000C0 J.D.= 2438607.91666666 JULY 31,1964 10 00 00.000
TFL 2 DAYS 17 HRS. 9 MIN. 52.127 SEC.

GEOCENTRIC — EQUATORIAL COORDINATES

X	.30912585 06	Y	.18223786 06	Z	.46769492 05	DX	.69925626 00	DY	.48232034 00	DZ	.16224628 00
R	.36187956 06	DEC	.74257064 01	RA	.30520471 02	V	.86482141 00	PTH	.84740169 02	AZ	.49604837 02
R	.36187955 06	LAT	.74257064 01	LON	.29146630 03	VE	.26121229 02	PTE	.18893020 01	AZE	.27011276 03
XS	-.93923636 08	YS	.10946060 09	ZS	.47466914 08	DXS	-.22925317 02	DYS	-.16798376 02	DZS	-.72839797 01
XM	.32875724 06	YM	.17824451 06	ZM	.44270173 05	DXM	-.53784354 00	DYM	.79728218 00	DZM	.39680075 00
XT	.32875724 06	YT	.17824451 06	ZT	.44270173 05	DXT	-.53784354 00	DYT	.79728218 00	DZT	.39680075 00
RS	.15184328 09	VS	.29339597 02	RM	.37657971 06	VM	.10403775 01	RT	.37657971 06	VT	.10403775 01
GED	.74757405 01	ALT	.35550171 06	LOS	.31577353 02	RAS	.13063153 03	RAM	.28465515 02	LOM	.28941133 03
DUT	.35000000 02	DT	.48000000 03	DR	.86117985 00	SHA	.35904312 06	DES	.18216268 02	DEM	.67512227 01

HELIOCENTRIC — EQUATORIAL COORDINATES

X	.94232762 08	Y	-.10927836 09	Z	-.47420144 08	DX	.23624574 02	DY	.17280696 02	DZ	.74462260 01
R	.15188892 09	LAT	-.18192030 02	LON	.31077181 03	V	.30202470 02	PTH	-.19107454 00	AZ	.75023618 02
XE	.93923636 08	YE	-.10946060 09	ZE	-.47466914 08	DXE	.22925317 02	DYE	.16798376 02	DZE	.72839797 01
XT	.94252394 08	YT	-.10928236 09	ZT	-.47422644 08	DXT	.22387474 02	DYT	.17595658 02	DZT	.76807805 01
LTE	-.18216268 02	LOE	.31063153 03	LTT	-.18191059 02	LOT	.31077667 03	RST	.15190475 09	VST	.29492381 02
EPS	.82686187 02	ESP	.13525975 00	SEP	.97178372 02	EPM	.13564575 03	EMP	.42206363 02	MEP	.21478767 01
MPS	.14165033 03	MSP	.27453512-18	SMP	.38344940 02	SEM	.99325661 02	EMS	.80534176 02	ESM	.14023158 00
RPM	.20188732 05	SPN	.81676316 02								
GCE	.10056410 03	GCT	.27904504 03	SIP	.13672031 03	CPT	.94608550 02	SIN	.89678524 02	D1	.25877444 01
REP	.36187956 06	VEP	.86482141 00	CPE	.98555130 02	CPS	.77074689 02	D2	.21359120 01	D3	.28218266 00

SELENOCENTRIC — EQUATORIAL COORDINATES

X	-.19631390 05	Y	.39933513 04	Z	.24993193 04	DX	.12370998 01	DY	-.31496184 00	DZ	-.23455447 00
R	.20188732 05	DEC	.71113324 01	RA	.16850196 03	V	.12979340 01	PTH	-.85702498 02	AZ	.14036327 03
R	.20188731 05	LAT	.34742235 01	LON	.31246281 03	VP	.12954454 01	PTP	-.87574251 02	AZP	.14372974 03
LTS	.93999368 00	LNS	.27416904 03	LTE	.59554058 01	LNE	.35474950 03				
ALT	.18453732 05	SHA	-.12524976 05	ALP	.25108051 01	DR	-.12942847 01	DP	.27602750-03	ASD	.49300245 01
HGE	.27731381 03	SVL	-.94244572 00	HNG	.14166013 03	SIA	.13071572 03				

2 DAYS 0 HRS. 32 MIN. 2.000 SEC. 2356666336142020000000000 J.D.= 2438607.95833333 JULY 31,1964 11 00 00.000
TFL 2 DAYS 18 HRS. 9 MIN. 52.127 SEC.

GEOCENTRIC — EQUATORIAL COORDINATES

X	.31171641 06	Y	.18394624 06	Z	.47340034 05	DX	.74492919 00	DY	.46596135 00	DZ	.15430614 00
R	.36502660 06	DEC	.74516381 01	RA	.30545177 02	V	.89210417 00	PTH	.87095193 02	AZ	.30159509 02
R	.36502660 06	LAT	.74516381 01	LON	.27644993 03	VE	.26385722 02	PTE	.19350540 01	AZE	.27008493 03
XS	-.94006147 08	YS	.10940010 09	ZS	.47440679 08	DXS	-.22912602 02	DYS	-.16813370 02	DZS	-.72904710 01
XM	.32680488 06	YM	.18110588 06	ZM	.45696440 05	DXM	-.54679476 00	DYM	.79234964 00	DZM	.39556261 00
XT	.32680488 06	YT	.18110588 06	ZT	.45696440 05	DXT	-.54679476 00	DYT	.79234964 00	DZT	.39556261 00
RS	.15184253 09	VS	.29339865 02	RM	.37641590 06	VM	.10408036 01	RT	.37641590 06	VT	.10408036 01
GED	.75018430 01	ALT	.35864876 06	LOS	.16576813 02	RAS	.13067206 03	RAM	.28993958 02	LOM	.27489871 03
DUT	.35000000 02	DT	.24000000 03	DR	.89095794 00	SHA	.36215916 06	DES	.18205939 02	DEM	.69728392 01

HELIOCENTRIC — EQUATORIAL COORDINATES

X	.94317863 08	Y	-.10921615 09	Z	-.47393339 08	DX	.23657531 02	DY	.17279331 02	DZ	.74447772 01
R	.15188863 09	LAT	-.18181423 02	LON	.31081353 03	V	.30227119 02	PTH	-.10841303 00	AZ	.75012011 02
XE	.94006147 08	YE	-.10940010 09	ZE	-.47440679 08	DXE	.22912602 02	DYE	.16813370 02	DZE	.72904710 01
XT	.94332952 08	YT	-.10921899 09	ZT	-.47394583 08	DXT	.22365807 02	DYT	.17605720 02	DZT	.76860336 01
LTE	-.18205939 02	LOE	.31067206 03	LTT	-.18180598 02	LOT	.31081732 03	RST	.15190055 09	VST	.29483313 02
EPS	.82677043 02	ESP	.13669873 00	SEP	.97186339 02	EPM	.13671458 03	EMP	.41673710 02	MEP	.16116918 01
MPS	.14055750 03	MSP	.18000000 03	SMP	.39438798 02	SEM	.98796699 02	EMS	.81062986 02	ESM	.14023158 00
RPM	.15441205 05	SPN	.81675881 02								
GCE	.10055750 03	GCT	.278C3952 03	SIP	.13410602 03	CPT	.94938326 02	SIN	.88486849 02	D1	.33923332 01
REP	.36502660 06	VEP	.89210417 00	CPE	.98547232 02	CPS	.77078923 02	D2	.28034234 01	D3	.46635502 00

SELENOCENTRIC — EQUATORIAL COORDINATES

X	-.15088464 05	Y	.28403666 04	Z	.16435937 04	DX	.12917239 01	DY	-.32638830 00	DZ	-.24125647 00
R	.15441205 05	DEC	.61102564 01	RA	.16933897 03	V	.13539884 01	PTH	-.84579439 02	AZ	.14024974 03
R	.15441204 05	LAT	.28844845 01	LON	.31307572 03	VP	.13511256 01	PTP	-.86060692 02	AZP	.12854752 03
LTS	.94081246 00	LNS	.27366007 03	LTE	.59239690 01	LNE	.35477229 03				
ALT	.13706205 05	SHA	-.98090815 04	ALP	.16877161 01	DR	-.13479336 01	DP	.47460112-03	ASD	.64514764 01
HGE	.27732296 03	SVL	-.15993793 01	HNG	.14058465 03	SIA	.13026311 03				

2 DAYS 1 HRS. 32 MIN. 2.000 SEC. 2356666354202020000000000 J.D.= 2438608.00000000 JULY 31,1964 12 00 00.000
TFL 2 DAYS 19 HRS. 9 MIN. 52.127 SEC.

GEOCENTRIC — EQUATORIAL COORDINATES

X	.31454879 06	Y	.18558384 06	Z	.47876595 05	DX	.84271238 00	DY	.44189690 00	DZ	.14311788 00
R	.36834016 06	DEC	.74683968 01	RA	.30540609 02	V	.96224724 00	PTH	.86958617 02	AZ	.29109829 03
R	.36834015 06	LAT	.74683968 01	LON	.26140429 03	VE	.26696863 02	PTE	.20626736 01	AZE	.27003947 03
XS	-.94088612 08	YS	.10933954 09	ZS	.47414421 08	DXS	-.22899874 02	DYS	-.16828357 02	DZS	-.72969592 01
XM	.32482037 06	YM	.18394934 06	ZM	.47118180 05	DXM	-.55570460 00	DYM	.78733362 00	DZM	.39428431 00
XT	.32482037 06	YT	.18394934 06	ZT	.47118180 05	DXT	-.55570460 00	DYT	.78733362 00	DZT	.39428431 00
RS	.15184179 09	VS	.29340134 02	RM	.37625224 06	VM	.10412310 01	RT	.37625224 06	VT	.10412310 01
GED	.75187120 01	ALT	.36196232 06	LOS	.15762634 01	RAS	.13071258 03	RAM	.29523351 02	LOM	.26038703 03
DUT	.35000000 02	DT	.12000000 03	DR	.96089190 00	SHA	.36541573 06	DES	.18195601 02	DEM	.71940563 01

HELIOCENTRIC — EQUATORIAL COORDINATES

X	.94403161 08	Y	-.10915396 09	Z	-.47366545 08	DX	.23742587 02	DY	.17270254 02	DZ	.74400771 01
R	.15188855 09	LAT	-.18170793 02	LON	.31085530 03	V	.30287404 02	PTH	.47925729-01	AZ	.75000118 02
XE	.94088612 08	YE	-.10933954 09	ZE	-.47414421 08	DXE	.22899874 02	DYE	.16828357 02	DZE	.72969592 01
XT	.94413433 08	YT	-.10915559 09	ZT	-.47367303 08	DXT	.22344170 02	DYT	.17615691 02	DZT	.76912436 01
LTE	-.18195601 02	LOE	.31071258 03	LTT	-.18170130 02	LOT	.31085796 03	RST	.15189635 09	VST	.29474221 02
EPS	.82637423 02	ESP	.13741256 00	SEP	.97224731 02	EPM	.13882450 03	EMP	.40129924 02	MEP	.10455350 01
MPS	.13837408 03	MSP	.27453512-18	SMP	.41623305 02	SEM	.98267257 02	EMS	.81592292 02	ESM	.14057998 00
RPM	.10428417 05	SPN	.81645267 02								
GCE	.10054985 03	GCT	.27621877 03	SIP	.12879711 03	CPT	.95563982 02	SIN	.85987014 02	D1	.50617151 01
REP	.36834016 06	VEP	.96224724 00	CPE	.98530790 02	CPS	.77083170 02	D2	.41945804 01	D3	.96113168 00

SELENOCENTRIC — EQUATORIAL COORDINATES

X	-.10271567 05	Y	.16345024 04	Z	.75841539 03	DX	.13984170 01	DY	-.34543671 00	DZ	-.25116643 00
R	.10428417 05	DEC	.41705655 01	RA	.17095839 03	V	.14621837 01	PTH	-.82535466 02	AZ	.14028300 03
R	.10428415 05	LAT	.17443509 01	LON	.31477895 03	VP	.14591995 01	PTP	-.83490510 02	AZP	.12126005 03
LTS	.94163036 00	LNS	.27315108 03	LTE	.58919166 01	LNE	.35479549 03				
ALT	.86934166 04	SHA	-.69268704 04	ALP	.26485467 00	DR	-.14497924 01	DP	.10436551-02	ASD	.95769668 01
HGE	.27736257 03	SVL	-.28754481 01	HNG	.13845542 03	SIA	.12924753 03				

2 DAYS 2 HRS. 32 MIN. 2.000 SEC. 2356666372242020000000000 J.D.= 2438608.04166666 JULY 31,1964 13 00 00.000
TFL 2 DAYS 20 HRS. 9 MIN. 52.127 SEC.

GEOCENTRIC — EQUATORIAL COORDINATES

X	.31802455 06	Y	.18710406 06	Z	.48369947 05	DX	.11756720 01	DY	.39760646 00	DZ	.13512609 00
R	.37213868 06	DEC	.74683388 01	RA	.30469665 02	V	.12484208 01	PTH	.78232968 02	AZ	.26460562 03
R	.37213867 06	LAT	.74683388 01	LON	.24629228 03	VE	.27187535 02	PTE	.25765343 01	AZE	.26994950 03
XS	-.94171030 08	YS	.10927893 09	ZS	.47388139 08	DXS	-.22887135 02	DYS	-.16843337 02	DZS	-.73034444 01
XM	.32280385 06	YM	.18677459 06	ZM	.48535243 05	DXM	-.56457204 00	DYM	.78223440 00	DZM	.39296588 00
XT	.32280385 06	YT	.18677459 06	ZT	.48535243 05	DXT	-.56457204 00	DYT	.78223440 00	DZT	.39296588 00
RS	.15184104 09	VS	.29340403 02	RM	.37608875 06	VM	.10416594 01	RT	.37608875 06	VT	.10416594 01
GED	.75186536 01	ALT	.36576C83 06	LOS	.34657571 03	RAS	.13075309 03	RAM	.30053709 02	LOM	.24587633 03
DUT	.35000000 02	DT	.10874C23 02	DR	.12221852 01	SHA	.36909683 06	DES	.18185254 02	DEM	.74148533 01

HELIOCENTRIC — EQUATORIAL COORDINATES

X	.94489054 08	Y	-.10909183 09	Z	-.47339769 08	DX	.24062807 02	DY	.17240944 02	DZ	.74385705 01
R	.15188898 09	LAT	-.18160111 02	LON	.31089722 03	V	.30522142 02	PTH	.50283682 00	AZ	.74967017 02
XE	.94171030 08	YE	-.10927893 09	ZE	-.47388139 08	DXE	.22887135 02	DYE	.16843337 02	DZE	.73034444 01
XT	.94493834 08	YT	-.10909216 09	ZT	-.47339604 08	DXT	.22322563 02	DYT	.17625572 02	DZT	.76964103 01
LTE	-.18185254 02	LOE	.31075309 03	LTT	-.18159655 02	LOT	.31089857 03	RST	.15189214 09	VST	.29465103 02
EPS	.82529993 02	ESP	.13918114 00	SEP	.97330771 02	EPM	.14528346 03	EMP	.34300631 02	MEP	.41590080 00
MPS	.13121376 03	MSP	.27453512-18	SMP	.48784876 02	SEM	.97737333 02	EMS	.82122090 02	ESM	.14075386 00
RPM	.47935001 04	SPN	.81547967 02								
GCE	.10053604 03	GCT	.27135734 03	SIP	.10999385 03	CPT	.97461787 02	SIN	.76241881 02	D1	.11648226 02
REP	.37213868 06	VEP	.12484208 01	CPE	.98491662 02	CPS	.77087439 02	D2	.98312970 01	D3	.39614385 01

SELENOCENTRIC — EQUATORIAL COORDINATES

X	-.47793061 04	Y	.32947533 03	Z	-.16529600 03	DX	.17402440 01	DY	-.38462794 00	DZ	-.25783979 00
R	.47935001 04	DEC	-.19761419 01	RA	.176C5639 03	V	.18007968 01	PTH	-.76719273 02	AZ	.14033868 03
R	.47934998 04	LAT	-.18640482 01	LON	.32135277 03	VP	.17981981 01	PTP	-.77074736 02	AZP	.11764555 03
LTS	.94244913 00	LNS	.27264208 03	LTE	.58592504 01	LNE	.35481910 03				
ALT	.30585001 04	SHA	-.36058673 04	ALP	.29813306 01	DR	-.17526367 01	DP	.49446745-02	ASD	.21219905 02
HGE	.27747000 03	SVL	-.68918511 01	HNG	.13158003 03	SIA	.12406355 03				

2 DAYS 2 HRS. 57 MIN. 50.724 SEC. 2356666402720202134471652 J.D.= 2438608.05959170 JULY 31,1964 13 25 48.724
TFL 2 DAYS 20 HRS. 35 MIN. 40.850 SEC.

GEOCENTRIC — EQUATORIAL COORDINATES

X	.32029137 06	Y	.18771490 06	Z	.48627681 05	DX	.20228714 01	DY	.43325334 00	DZ	.28010270 00
R	.37441700 06	DEC	.74624118 01	RA	.30373517 02	V	.20876241 01	PTH	.71875024 02	AZ	.27199566 03
R	.37441700 06	LAT	.74624118 01	LON	.23972546 03	VE	.27791636 02	PTE	.40938113 01	AZE	.27004674 03
XS	-.94206472 08	YS	.10925284 09	ZS	.47376826 08	DXS	-.22881651 02	DYS	-.16849780 02	DZS	-.73062334 01
XM	.32192653 06	YM	.18798434 06	ZM	.49143391 05	DXM	-.56837352 00	DYM	.78001519 00	DZM	.39238635 00
XT	.32192653 06	YT	.18798434 06	ZT	.49143391 05	DXT	-.56837352 00	DYT	.78001519 00	DZT	.39238635 00
RS	.15184073 09	VS	.29340519 02	RM	.37601845 06	VM	.10418441 01	RT	.37601845 06	VT	.10418441 01
GED	.75126876 01	ALT	.36803916 06	LOS	.34012246 03	RAS	.13077052 03	RAM	.30282171 02	LOM	.23963411 03
DUT	.35000000 02	DT	.59999999 02	DR	.19840367 01	SHA	.37126505 06	DES	.18180801 02	DEM	.75097041 01

HELIOCENTRIC — EQUATORIAL COORDINATES

X	.94526763 08	Y	-.10906512 09	Z	-.47328199 08	DX	.24904522 02	DY	.17283033 02	DZ	.75863361 01
R	.15188966 09	LAT	-.18155434 02	LON	.31091548 03	V	.31248854 02	PTH	.13294297 01	AZ	.74741742 02
XE	.94206472 08	YE	-.10925284 09	ZE	-.47376826 08	DXE	.22881651 02	DYE	.16849780 02	DZE	.73062334 01
XT	.94528399 08	YT	-.10906486 09	ZT	-.47327683 08	DXT	.22313277 02	DYT	.17629795 02	DZT	.76986198 01
LTE	-.18180801 02	LOE	.31077052 03	LTT	-.18155146 02	LOT	.31091604 03	RST	.15189032 09	VST	.29461173 02
EPS	.82420257 02	ESP	.13988231 00	SEP	.97439692 02	EPM	.15727330 03	EMP	.22624523 02	MEP	.10111274 00
MPS	.11247405 03	MSP	.27453512-18	SMP	.67525337 02	SEM	.97509211 02	EMS	.82350162 02	ESM	.14057998 00
RPM	.17356000 04	SPN	.81444206 02								
GCE	.10051381 03	GCT	.26267396 03	SIP	.23980679 02	CPT	.10155231 03	SIN	.13058930 02	D1	.11406418 04
REP	.37441700 06	VEP	.20876241 01	CPE	.98443461 02	CPS	.77089279 02	D2	.15031028 03	D3	.17941476 05

SELENOCENTRIC — EQUATORIAL COORDINATES

X	-.16351617 04	Y	-.26943836 03	Z	-.51570976 03	DX	.25912449 01	DY	-.34676184 00	DZ	-.11228365 00
R	.17356000 04	DEC	-.17285682 02	RA	.18935699 03	V	.26167540 01	PTH	-.64108713 02	AZ	.13807634 03
R	.17355998 04	LAT	-.10701742 02	LON	.33933139 03	VP	.26149378 01	PTP	-.64190798 02	AZP	.11489059 03
LTS	.94280089 00	LNS	.27242310 03	LTE	.58450103 01	LNE	.35482939 03				
ALT	.60000610 00	SHA	-.16037788 04	ALP	.51316863 01	DR	-.23540952 01	DP	.37721088-01	ASD	.88493376 02
HGE	.27757974 03	SVL	-.16444734 02	HNG	.11348877 03	SIA	.68779927 02				

SELENOCENTRIC CONIC

EPOCH OF PERICENTER PASSAGE 2356666402462022326312 52 J.D.= 2438608.06621769 JULY 31,1964 13 35 21.209

SMA	-.40924673 04	ECC	.10936292 01	B	.18119268 04	SLR	.80222497 03	APO	.00000000 00	RCA	.38317434 03
VH	.10945111 01	C3	.11979546 01	C1	.19831743 04	TFP	-.57248583 03	TF	.51123112 02	LTF	.51030153 02
TA	-.11945509 03	MTA	.15611878 03	EA	-.43490106 02	MA	-.87724788 01	C3J	-.21690818 01	TFI	.50964089 02
ZAE	.13175636 03	ZAP	.14584314 03	ZAC	.93425549 02	DEF	.13223756 03	IR	.41486246 04	GP	.78476824 00
OP1	.75797424 01	OY	-.62913155 01	OP2	-.12813277 02						

ALL VECTORS REFERENCED TO EARTH EQUATOR PLANE

X	-.16351617 04	Y	-.26943836 03	Z	-.51570976 03	DX	.25912449 01	DY	-.34676184 00	DZ	-.11228365 00
INC	.50359882 02	LAN	.35441699 03	APF	.32215206 03	MX	.32676819 00	MY	-.62330548 00	MZ	-.71043144 00
WX	-.74917743-01	WY	-.76641383 00	WZ	.63796332 00	PX	.74781483 00	PY	-.46639898 00	PZ	-.47248803 00
QX	.65966680 00	QY	.44168670 00	QZ	.60807719 00	RX	-.17986102 00	RY	.46846439-01	RZ	-.98257589 00
BX	-.30044386 00	BY	-.59268478 00	BZ	-.74730063 00	TX	-.25204997 00	TY	-.96771422 00	TZ	.00000000 00
SXI	.95085266 00	SYI	-.24765823 00	SZI	-.18586171 00	DAI	-.10711377 02	RAI	.34540115 03		
SXO	-.41673125 00	SYO	.60527986 00	SZO	.67821187 00	DAO	.42704068 02	RAO	.12454716 03		
ETE	.20031439 03	ETS	.16619735 02	ETC	.30470558 03						
BTQ	.11764413 04	BRC	.13780656 04	B	.18119268 04	THA	.49512931 02				

ALL VECTORS REFERENCED TO ORBIT PLANE OF TARGET

X	.15283933 04	Y	.64237390 03	Z	-.51349501 03	DX	-.26025240 01	DY	.46405144-01	DZ	.26854588 00
INC	.28507792 02	LAN	.16802834 03	APF	.33776319 03	MX	-.23128111-02	MY	-.79848254 00	MZ	.42450940 00
WX	.99000716-01	WY	.46689763 00	WZ	.87875220 00	PX	-.83651551 00	PY	.51731867 00	PZ	-.18061887 00
QX	-.53892544 00	QY	-.71720843 00	QZ	.44178201 00	RX	-.13465834-01	RY	.25021907-02	RZ	-.99990619 00
BX	.15412983 00	BY	.86523814 00	BZ	-.47708170 00	TX	.18269050 00	TY	.98317048 00	TZ	.00000000 00
SXI	-.98307824 00	SYI	.18267336 00	SZI	.13696337-01	DAI	.78476568 00	RAI	.16947348 03		
SXO	.54671913 00	SYO	-.76338529 00	SZO	.34400732 00	DAO	.20121210 02	RAO	.30560937 03		
ETE	.16320991 03	ETS	.32510480 03	ETC	.26136655 03						
BTO	.15923842 04	BRO	.86451828 03	B	.18119270 04	THA	.28497891 02				

ALL VECTORS REFERENCED TO TRUE LUNAR EQU. PLANE

X	.15956483 04	Y	-.60194627 03	Z	-.32229479 03	DX	-.10813893 01	DY	.18184166 01	DZ	-.33690046-01
INC	.26870079 02	LAN	.13743128 03	APF	.32371401 03	MX	.39576458-01	MY	-.74956415 00	MZ	.26613307 00
WX	.30574512 00	WY	.33286006 00	WZ	.89203367 00	PX	-.23652238 00	PY	.93408262 00	PZ	-.26748232 00
QX	-.92226734 00	QY	-.12920450 00	QZ	.36432005 00	RX	.57520670-01	RY	-.78217226-01	RZ	-.99527553 00
BX	.74755515 00	BY	.49629825 00	BZ	-.44141742 00	TX	.80561166 00	TY	.59244396 00	TZ	.00000000 00
SXI	-.58964498 00	SYI	.80180559 00	SZI	-.97090483-01	DAI	-.55716532 01	RAI	.12633063 03		
SXO	-.15709904 00	SYO	-.90642025 00	SZO	.39207418 00	DAO	.23083622 02	RAO	.26016727 03		
ETE	.11251584 00	ETS	.18146912 03	ETC	.25513309 03						
BTT	.16239736 04	BRT	.80361342 03	B	.18119285 04	THA	.26328224 02				

222462325462 220750470503 215753220702 201560037435 200757472124 177435676652
640702910 2758000 000000000000

APPENDIX D

Tables related to trajectory printout

Table D-1. *Ranger VII* trajectory key

COLUMN / ROW		1	2	3	4	5	6
	1	GME	J	H	D	RE	REM
	2	G	A	B	C	OME	AU
GROUP A	3	GMM	GMS	GMV	GMA	GMB	GMJ
	4	EGM	MGM	JA			RA
	5	ARA	GB	MAS			SC
		INJECTION CONDITIONS		TARGET	JULIAN DATE	MONTH, DAY, YEAR	hr, min, sec
GROUP B	6	GEOCENTRIC	XO	YO	ZO DXO	DYO	DZO
	7	CARTESIAN			TO GHA	GHO	
		TIME PAST INJECTION			JULIAN DATE	MONTH, DAY, YEAR	hr, min, sec
		GEOCENTRIC				EQUATORIAL COORDINATES	
	8	X	Y	Z	DX	DY	DZ
	9	R	DEC	RA	V	PTH	AZ
	10	R	LAT	LON	VE	PTE	AZE
	11	XS	YS	ZS	DXS	DYS	DZS
GROUP C	12	XM	YM	ZM	DXM	DYM	DZM
	13	XT	YT	ZT	DXT	DYT	DZT
	14	RS	VS	RM	VM	RT	VT
	15	GED	ALT	LOS	RAS	RAM	LOM
	16	DUT	DT	DR	SHA	DES	DEM
				GEOCENTRIC CONIC			
		EPOCH PERICENTER PASSAGE			JULIAN DATE	MONTH, DAY, YEAR	hr, min, sec
	17	SMA	ECC	B	SLR	APO	RCA
GROUP D	18	VH	C3	C1	TFP	TF	PER
	19	TA	MTA	EA	MA	C3J	TFI
				ALL VECTORS REFERENCED TO EARTH EQUATOR PLANE			
	20	X	Y	Z	DX	DY	DZ
	21	INC	LAN	APF	MX	MY	MZ
	22	WX	WY	WZ	PX	PY	PZ
GROUP E	23	QX	QY	QZ	RX	RY	RZ
	24	BX	BY	BZ	TX	TY	TZ
	25	DAP	RAP				
	26	BTQ	BRQ	B	THA		
		HELIOCENTRIC				EQUATORIAL COORDINATES	
	27	X	Y	Z	DX	DY	DZ
	28	R	LAT	LON	V	PTH	AZ
	29	XE	YE	ZE	DXE	DYE	DZE
	30	XT	YT	ZT	DXT	DYT	DZT
	31	LTE	LOE	LTT	LOT	RST	VST
GROUP F	32	EPS	ESP	SEP	EPM	EMP	MEP
	33	MPS	MSP	SMP	SEM	EMS	ESM
	34	EPT	ETP	TEP	TPS	TSP	STP
	35	SET	STE	EST	RPM	RPT	SPN
	36	GCE	GCT	SIP	CPT	SIN	D1
	37	REP	VEP	CPE	CPS	D2	D3

Table D-1. *Ranger VII* trajectory key (Cont'd)

	COLUMN / ROW	1	2	3	4	5	6
		SELENOCENTRIC				EQUATORIAL COORDINATES	
GROUP G	38	X	Y	Z	DX	DY	DZ
	39	R	DEC	RA	V	PTH	AZ
	40	R	LAT	LON	VP	PTP	AZP
	41	LTS	LNS	LTE	LNE		
	42	ALT	SHA	ALP	DR	DP	ASD
	43	HGE	SVL	HNG	SIA		
				SELENOCENTRIC CONIC			
		EPOCH OF PERICENTER PASSAGE			JULIAN DATE	MONTH, DAY, YEAR	hr, min, sec
GROUP H	44	SMA	ECC	B	SLR	APO	RCA
	45	VH	C3	C1	TFP	TF	LTF
	46	TA	MTA	EA	MA	C3J	TFI
	47	ZAE	ZAP	ZAC	DEF	IR	GP
	48	OP1	OY	OP2			
					ALL VECTORS REFERENCED TO PRINCIPAL PLANE		
GROUP I	49	X	Y	Z	DX	DY	DZ
	50	INC	LAN	APF	MX	MY	MZ
	51	WX	WY	WZ	PX	PY	PZ
	52	QX	QY	QZ	RX	RY	RZ
	53	BX	BY	BZ	TX	TY	TZ
	54	SXI	SYI	SZI	DAI	RAI	
	55	SXO	SYO	SZO	DAO	RAO	
	56	ETE	ETS	ETC			
	57	BT—	BR—	B	THA		
GROUP J	58	XOCTAL YOCTAL	ZOCTAL	$\dot{X}$OCTAL	$\dot{Y}$OCTAL	$\dot{Z}$OCTAL	
	59		YYMMDDDHH	TTSSSSS		SOCTAL	

Table D-2. *Ranger VII* trajectory key definitions

Group A		
Row 1	GME	Universal gravitational constant times the mass of Earth, km^3/sec^2
	J	Coefficient of the second harmonic in the Earth's potential function
	H	Coefficient of the third harmonic in the Earth's potential function
	D	Coefficient of the fourth harmonic in the Earth's potential function
	RE	Earth radius used in the potential function, km
	REM	Conversion factor for converting lunar ephemerides into km
Row 2	G	Universal constant of gravitation, $km^3/kg\ sec^2$
	A, B, C	Moments of inertia about principal axis for the Moon, $kg\ km^2$
	OME	Sidereal rotation rate of the Earth, deg/sec
	AU	Astronomical unit, km
Row 3	GMM	Universal gravitational constant times the mass of Moon, km^3/sec^2
	GMS	Universal gravitational constant times the mass of Sun, km^3/sec^2
	GMV	Universal gravitational constant times the mass of Venus, km^3/sec^2
	GMA	Universal gravitational constant times the mass of Mars, km^3/sec^2
	GMB	Universal gravitational constant times the mass of Earth–Moon, km^3/sec^2
	GMJ	Universal gravitational constant times the mass of Jupiter, km^3/sec^2
Row 4	EGM	Universal gravitational constant times the mass of Earth used for scaling ephemeris, km^3/sec^2
	MGM	Universal gravitational constant times the mass of Moon used for scaling ephemeris, km^3/sec^2
	JA	Coefficient of second harmonic in Mars potential function
	RA	Mars radius used in the potential function
Row 5	ARA	Frontal area of spacecraft, m^2
	GB	Multiple of % of reflected radiant energy
	MAS	Mass of spacecraft, kg
	SC	Solar radiation constant $(kg\text{-}km/sec^2)\ 10^{-6}$
Group B		Injection conditions are vernal equinox Cartesian coordinates in a geocentric equatorial system. The principal direction X is the vernal equinox direction of date, and the principal plane XY is the equatorial plane of date. Z is along the direction of the Earth's spin axis of date.
Row 6	XO, YO, ZO	Cartesian components of the probe radius vector, km
	DXO, DYO, DZO	Cartesian components of the probe space-fixed velocity vector, km/sec
Row 7	TO	Time of injection in seconds past midnight of day before launch, sec
	GHA	HA of Greenwich at injection epoch, deg
	GHO	HA of Greenwich at midnight of day before launch, deg
Group C		Inertial position and velocity of the probe, Sun, Moon and target body in a geocentric equatorial system. The principal direction X is the vernal equinox direction of date, and the principal plane XY is the equatorial plane of date. Z is along the direction of the Earth's spin axis of date. Miscellaneous parameters are also included.
Row 8	X, Y, Z	Cartesian components of the probe radius vector, km
	DX, DY, DZ	Cartesian components of the probe space-fixed velocity vector, km/sec
Row 9	R	Probe radius distance, km
	DEC	Probe declination angle, deg
	RA	Probe right-ascension angle, deg
	V	Probe space-fixed velocity, km/sec
	PTH	Pitch angle of the probe space-fixed velocity vector with respect to the local horizontal, deg
	AZ	Azimuth angle of the probe space-fixed velocity vector measured East of true North, deg

Table D-2. *Ranger VII* trajectory key definitions (Cont'd)

Row 10*	R	Probe radius distance, km
	LAT	Probe geocentric latitude, deg
	LON	Probe East longitude, deg
	VE	Probe Earth-fixed velocity, km/sec
	PTE	Pitch angle of the probe Earth-fixed velocity vector with respect to the local horizontal, deg
	AZE	Azimuth angle of the probe Earth-fixed velocity vector measured East of true North, deg
Row 11	XS, YS, ZS	Cartesian components of the Sun radius vector, km
	DXS, DYS, DZS	Cartesian components of the Sun space-fixed velocity vector, km/sec
Row 12	XM, YM, ZM	Cartesian components of the Moon radius vector, km
	DXM, DYM, DZM	Cartesian components of the Moon space-fixed velocity vector, km/sec
Row 13	XT, YT, ZT	Cartesian components of the target radius vector, km
	DXT, DYT, DZT	Cartesian components of the target space-fixed velocity vector, km/sec
Row 14	RS	Sun radius distance, km
	VS	Sun space-fixed velocity, km/sec
	RM	Moon radius distance, km
	VM	Moon space-fixed velocity, km/sec
	RT	Target radius distance, km
	VT	Target space-fixed velocity, km/sec
Row 15	GED	Geodetic latitude of the probe, deg
	ALT	Altitude of the probe above the Earth's surface, km
	LOS	East longitude of the Sun in coordinate system defined in Row 10, deg
	RAS	Right ascension of the Sun, deg
	RAM	Right ascension of the Moon, deg
	LOM	East longitude of the Moon in coordinate system defined in Row 10, deg
Row 16	DUT	Ephemeris time minus Universal Time, sec
	DT	Adams–Moulton step size, sec
	DR	Radial velocity of probe, km/sec
	SHA	Sun shadow parameter, km
	DES	Declination of the Sun, deg
	DEM	Declination of the Moon, deg
Group D		General characteristics of the geocentric conic
Row 17	SMA	Semimajor axis, km
	ECC	Eccentricity
	B	Magnitude of the impact parameter,** km
	SLR	Semilatus rectum, km
	APO	Apogee distance, km
	RCA	Magnitude of the closest approach vector, km
Row 18	VH	Hyperbolic excess speed, km/sec
	C3	Twice the energy (*vis viva* energy integral, km^2/sec^2)
	C1	Angular momentum, km^2/sec
	TFP	Time from pericenter passage, sec
	TF	Time from injection to pericenter passage, hr
	PER	Period, min
Row 19	TA	True anomaly, deg
	MTA	Maximum true anomaly, deg
	EA	Eccentric anomaly, deg
	MA	Mean anomaly, deg
	C3J	Earth–Moon Jacobi constant, km^2/sec^2
	TFI	Time from injection, hr
Group E		Characteristics of the Earth conic in the geocentric equatorial system described under Group B
Row 20	X, Y, Z	Cartesian components of the probe radius vector, km
	DX, DY, DZ	Cartesian components of the probe space-fixed velocity vector, km/sec
Row 21	INC	Inclination of the orbit plane to the equatorial plane, deg
	LAN	Longitude of the ascending node, deg
	APF	Argument of pericenter, deg

*These are Earth-fixed spherical coordinates in a geocentric equatorial system. The principal direction X is directed toward Greenwich and is the intersection or the meridian plane of Greenwich with the equatorial plane. The principal plane is the Earth's geometrical equatorial plane. X, Y, Z is along the direction of the Earth's geometrical North direction.

**See Appendix A.

Table D-2. *Ranger VII* trajectory key definitions (Cont'd)

Row 21 (Cont'd)	MX MY MZ	Components of a unit vector which lies in the orbit plane and is normal to the radius vector **R** $\mathbf{M} = \mathbf{W} \times \frac{\mathbf{R}}{\lvert\mathbf{R}\rvert}$
Row 22	WX WY WZ	Components of a unit vector normal to the conic $\mathbf{W} = \frac{\mathbf{R} \times \mathbf{V}}{\lvert\mathbf{R} \times \mathbf{V}\rvert}$
	PX PY PZ	Components of a unit vector in the direction of perigee
Row 23	QX QY QZ	Components of a unit vector perpendicular to the perigee direction, vector **P**, and being in the orbit plane $\mathbf{Q} = \mathbf{W} \times \mathbf{P}$
	RX RY RZ	Components of the unit vector **R****
Row 24	BX BY BZ	Components of the impact parameter **B**,** km
	TX TY TZ	Components of the unit vector **T****
Row 25	DAP	Declination of the asymptote, deg
	RAP	Right ascension of the asymptote, deg
Row 26	BTQ	Projection of the impact parameters **B**** upon the vector **T**, km
	BRQ	Projection of the impact parameters **B**** upon the vector **R**, km
	B	The magnitude of the impact parameter,** km
	THA	Angle between the parameter **B**** and the vector **T** measured clockwise from **T**, deg
Group F		Inertial position and velocity of the probe, Sun, Moon, and target body in a heliocentric equatorial system. The principal direction X is the vernal equinox direction of date and the principal plane XY is the equatorial plane of date. Z is along the direction of the Earth's spin axis of date. Miscellaneous parameters are also included.

Row 27	X Y Z	Cartesian components of the probe radius vector, km
	DX DY DZ	Cartesian components of the probe space-fixed velocity vector, km/sec
Row 28	R	Sun–probe radius distance, km
	LAT	Probe celestial declination, deg
	LON	Probe celestial right ascension, deg
	V	Probe space-fixed velocity, km/sec
	PTH	Pitch angle of the probe space-fixed velocity vector with respect to the local horizontal, deg
	AZ	Azimuth angle of the probe space-fixed velocity vector measured East of true North, deg
Row 29	XE YE ZE	Cartesian components of the Earth radius vector, km
	DXE DYE DZE	Cartesian components of the Earth space-fixed velocity vector, km/sec
Row 30	XT YT ZT	Cartesian components of the target radius vector, km
	DXT DYT DZT	Cartesian components of the target space-fixed velocity vector, km/sec
Row 31	LTE	Celestial latitude of the Earth, deg
	LOE	Celestial longitude of the Earth, deg
	LTT	Celestial latitude of the target, deg
	LOT	Celestial longitude of the target, deg
	RST	Sun–target range, km
	VST	Sun–target velocity, km/sec
Row 32	EPS	Earth–probe–Sun angle, deg
	ESP	Earth–Sun–probe angle, deg
	SEP	Sun–Earth–probe angle, deg
	EPM	Earth–probe–Moon angle, deg
	EMP	Earth–Moon–probe angle, deg
	MEP	Moon–Earth–probe angle, deg
Row 33	MPS	Moon–probe–Sun angle, deg
	MSP	Moon–Sun–probe angle, deg
	SMP	Sun–Moon–probe angle, deg
	SEM	Sun–Earth–Moon angle, deg
	EMS	Earth–Moon–Sun angle, deg
	ESM	Earth–Sun–Moon angle, deg
Row 34	EPT	Earth–probe–target angle, deg
	ETP	Earth–target–probe angle, deg
	TEP	Target–Earth–probe angle, deg
	TPS	Target–probe–Sun angle, deg
	TSP	Target–Sun–probe angle, deg
	STP	Sun–target–probe angle, deg

**See Appendix A.

Table D-2. *Ranger VII* trajectory key definitions (Cont'd)

Row 35	SET	Sun–Earth–target angle, deg
	STE	Sun–target–Earth angle, deg
	EST	Earth–Sun–target angle, deg
	RPM	Moon–probe radius distance, km
	RPT	Target–probe radius distance, km
	SPN	Sun–probe–near limb of Earth angle, deg
Row 36	GCE	Clock angle of Earth, deg
	GCT	Clock angle of target, deg
	SIP	Sun–probe–near limb of target angle, deg
	CPT	Canopus–probe–near limb of target angle, deg
	SIN	Canopus–probe–near limb of target angle, deg
	D1	Radius of a circle (target) used in construction of visible planet, cm
Row 37	REP	Earth–probe distance, km
	VEP	Velocity of the probe with respect to Earth, km/sec
	CPE	Canopus–probe–Earth angle, deg
	CPS	Canopus–probe–Sun angle, deg
	D2	Semiminor axis of ellipse used in construction of visible planet, cm
	D3	Distance from intersection of ellipse with circle to the diameter (of the circle) that is perpendicular to D1, in construction of visible planet, cm
Group G Row 38, 39		Inertial position of probe in a selenocentric equatorial system. The principal direction X is the vernal equinox direction of date and the principal plane XY is the geocentric equatorial plane of date. Z is along the direction of the Earth's spin axis of date.
Row 40, 41, 42		Selenocentric-fixed spherical coordinates of the probe, Sun, and Earth in a selenocentric equatorial system. The principal direction X is in the direction of the mean Moon–Earth line. The principal plane XY is the mean selenocentric equatorial plane. Z is along the direction of the Moon's mean spin axis. Miscellaneous parameters are also included.
Row 38	X, Y, Z	Cartesian components of the probe radius vector, km
	DX, DY, DZ	Cartesian components of the probe velocity vector, km/sec
Row 39	R	Probe radius distance, km
	DEC	Probe declination angle, deg
	RA	Probe right-ascension angle, deg
	V	Probe space-fixed velocity, km/sec
Row 39 (Cont'd)	PTH	Pitch angle of the probe space-fixed velocity vector with respect to the local horizontal, deg
	AZ	Azimuth angle of the probe space-fixed velocity vector measured East of true North, deg
Row 40	R	Probe radius distance, km
	LAT	Probe selenocentric latitude, deg
	LON	Probe selenocentric East longitude, deg
	VP	Probe selenocentric-fixed velocity, km/sec
	PTP	Pitch angle of the probe selenocentric-fixed velocity vector with respect to the local horizontal, deg
	AZP	Azimuth angle of the probe selenocentric fixed velocity vector measured East of the Moon's mean spin axis, deg
Row 41	LTS	Selenocentric latitude of the Sun, deg
	LNS	Selenocentric longitude of the Sun, deg
	LTE	Selenocentric latitude of the Earth, deg
	LNE	Selenocentric longitude of the Earth, deg
Row 42	ALT	Altitude of the probe above the Moon's surface, km
	SHA	Sun shadow parameter, km
	ALP	Illuminated crescent orientation viewing angle, deg
	DR	First time derivative of the probe radius distance, km/sec
	DP	First time derivative of the probe radius direction, deg/sec
	ASD	Angular semidiameter of Moon as seen from the probe, deg
Row 43	HGE	Right ascension of Earth in probe coordinate system,† deg
	SVL	Declination of the Moon in probe coordinate system,† deg
	HNG	Right ascension of the Moon in probe coordinate system,† deg
	SIA	Earth–probe–Moon angle minus ASD, deg
Group H		Characteristics of the selenocentric conic in the geocentric equatorial system described under Group B, except centered at the Moon.

†Same coordinate system as defined under Group B except centered at the probe.

Table D-2. *Ranger VII* trajectory key definitions (Cont'd)

Row 44	SMA	Semimajor axis, km
	ECC	Eccentricity
	B	The magnitude of the impact parameter,** km
	SLR	Semilatus rectum, km
	APO	Apogee distance, km
	RCA	Magnitude of the closest approach vector, km
Row 45	VH	Hyperbolic excess speed, km/sec
	C3	Twice the energy (*vis viva* energy integral, km^2/sec^2)
	C1	Angular momentum, km^2/sec
	TFP	Time from pericenter passage, sec
	TF	Time from injection to pericenter passage, hr
	LTF	Linearized time-of-flight, hr
Row 46	TA	True anomaly, deg
	MTA	Maximum true anomaly, deg
	EA	Eccentric anomaly, deg
	MA	Mean anomaly, deg
	C3J	Earth–Moon Jacobi constant, km^2/sec^2
	TFI	Time from injection, hr
Row 47	ZAE	Angle between the incoming asymptote and the Moon–Earth vector, deg
	ZAP	Angle between the incoming asymptote and the Moon–Sun vector, deg
	ZAC	Angle between the incoming asymptote and the Moon–Canopus vector, deg
	DEF	Angle between the incoming and outgoing asymptotes, deg
	IR	Maximum **B** vector magnitude for lunar impact, km
	GP	Angle between the incoming asymptote and its projection on the lunar orbital plane.
Row 48	OP1	Spacecraft nominal terminal maneuver first pitch turn, deg
	OY	Spacecraft nominal terminal maneuver yaw turn, deg
	OP2	Spacecraft nominal terminal maneuver second pitch turn, deg
Group I		Characteristics of the selenocentric conic in the specified "principal plane" coordinate system
Row 49	X, Y, Z	Cartesian components of the probe radius vector, km
	DX, DY, DZ	Cartesian components of the probe space-fixed velocity vector, km/sec
Row 50	INC	Inclination of the orbit plane to the equatorial plane, deg
	LAN	Longitude of the ascending node, deg
	APF	Argument of pericenter, deg
	MX, MY, MZ	Components of a unit vector which lies in the orbit plane and is normal to the radius vector **R** $\mathbf{M} = \mathbf{W} \times \frac{\mathbf{R}}{\lvert\mathbf{R}\rvert}$
Row 51	WX, WY, WZ	Components of a unit vector normal to the conic $\mathbf{W} = \frac{\mathbf{R} \times \mathbf{V}}{\lvert\mathbf{R} \times \mathbf{V}\rvert}$
	PX, PY, PZ	Components of a unit vector in the direction of perigee
Row 52	QX, QY, QZ	Components of a unit vector perpendicular to the perigee direction, vector **P**, and being in the orbit plane $\mathbf{Q} = \mathbf{W} \times \mathbf{P}$
	RX, RY, RZ	Components of the unit vector **R****
Row 53	BX, BY, BZ	Components of the impact parameter **B**,** km
	TX, TY, TZ	Components of the unit vector **T****
Row 54	SXI, SYI, SZI	Components of the unit vector $\mathbf{S}_I$** along the direction of the incoming asymptote
	DAI	Declination of the outgoing asymptote,** deg
	RAI	Right ascension of the incoming asymptote,** deg
Row 55	SXO, SYO, SZO	Components of the unit vector $\mathbf{S}_O$** along the direction of the outgoing asymptote
	DAO	Declination of the outgoing asymptote,** deg
	RAO	Right ascension of the outgoing asymptote,** deg
Row 56	ETE	Angle between the **T** vector and the projection of the Moon–Earth vector on the **R–T** plane, deg
	ETS	Angle between the **T** vector and the projection of the Moon–Sun vector on the **R–T** plane, deg
	ETC	Angle between the **T** vector and the projection of the Moon–Canopus vector on the **R–T** plane, deg

**See Appendix A.

Table D-2. *Ranger VII* trajectory key definitions (Cont'd)

Row 57	BT††	Projection of the impact parameter **B**** upon the vector **T**, km
	BR††	Projection of the impact parameter **B**** upon the vector **R**, km
	B	The magnitude of the impact parameter,** km
	THA	Angle between the parameter **B** and the vector **T**, measured clockwise from **T**, deg
Group J		Cartesian coordinates and epoch of injection conditions in the geocentric equatorial system described under Group B.
Row 58	XOCTAL YOCTAL ZOCTAL	Cartsian components of the probe radius vector at injection in octal representation, km
	ẊOCTAL ẎOCTAL ŻOCTAL	Cartesian components of the probe space-fixed velocity vector at injection in octal representation, km/sec

Row 59		Epoch of injection
	YY	Years past 1900
	MM	Month
	DDD	Day of month
	HH	Hours
	TT	Minutes
	SSSSS	Milliseconds
	SOCTAL	Seconds in octal representation, GMT
		Time past midnight on day (DD), month (MM), and year (YY + 1900) at which the injection epoch occurs is the time determined by the sum of HH, TT, SSSSS and SOCTAL.

††Principal planes:
- Q Earth equatorial plane
- C Ecliptic plane
- O Lunar orbital plane
- T True lunar equator.

**See Appendix A.

Table D-3. *Ranger VII* trajectory constants and conversion factors

Constants	Conversion factors
GM_{Sun}	$1.32715445 \times 10^{11}$ km^3/sec^2
GM_{Venus}	3.247695×10^5 km^3/sec^2
$GM_{\oplus}$*	3.986032×10^5 km^3/sec^2
$GM_{\oplus-\mathbb{C}}$	4.03503×10^5 km^3/sec^2
$GM_{\mathbb{C}}$**	4.900759×10^3 km^3/sec^2
GM_{Mars}	4.297780×10^4 km^3/sec^2
$GM_{Jupiter}$	1.267106×10^8 km^3/sec^2
M_{Sun}/M_{Venus}	408645
M_{Sun}/M_{Earth}	332951.3
M_{Earth}/M_{Moon}	81.335
$M_{Sun}/M_{Earth-Moon}$	328908
M_{Sun}/M_{Mars}	3,088,000
$M_{Sun}/M_{Jupiter}$	1047.39
Equatorial radius of Earth	6378.3149 km
1 AU	1.495990×10^8 km
Ellipticity of Earth	1/298.3
Conversion from feet to meters	0.3048
Atmospheric model	1959 ARDC
Sidereal rotation rate of Earth	4.1780742×10^{-3} deg/sec
Universal constant of gravitation	6.671×10^{-20} km^3/kg sec^2
Speed of light	2.997925×10^5 km/sec
Mean Moon radius	1738.09 km

Constants	Conversion factors
Moon moments of inertia about principal axis	$A = 0.88746 \times 10^{29}$ kg km^2 $B = 0.88764 \times 10^{29}$ kg km^2 $C = 0.88801 \times 10^{29}$ kg km^2
Lunar and solar ephemerides	The Moon and Sun positions are obtained from the joint JPL–STL ephemerides. For purposes of converting into kilometers, the conversion factors are: 1 AU = 1.495990×10^8 km 1 e.r. = 6378.3149
Geometrical Earth model, used in locating tracking and launching facilities upon the Earth	Clarke spheroid of 1866 a = 6378.2064 km b = 6356.5838 km $e^2 = 0.006768657997291$

Earth potential function:

$$\Phi(\mathbf{R}, \phi) = \frac{GM_{\oplus}}{\mathbf{R}}\left[1 + \frac{J\mathbf{R}_E^2}{3\mathbf{R}^2}(1 - 3\sin^2\phi) + \frac{H}{5}\frac{\mathbf{R}_E^3}{\mathbf{R}^3}(3 - 5\sin^2\phi)(\sin\phi) + \frac{D}{35}\frac{\mathbf{R}_E^4}{\mathbf{R}^4}(3 - 30\sin^2\phi + 35\sin^4\phi)\right]$$

where
- $\mathbf{R}$ = geocentric distance
- ϕ = geocentric latitude
- $J = 1.62345 \times 10^{-3}$
- $H = -0.575 \times 10^{-5}$
- $D = 0.7875 \times 10^{-5}$

*3.9860005×10^5 km^3/sec^2 was used for the premidcourse orbit.
**4.9007604×10^3 km^3/sec^2 was used for the premidcourse orbit.

APPENDIX E

Ranger VII premaneuver ODP printout

```
PAGE HEADING                                                          (23
(RA7 PRE M/C WITH POST DATA AS APRIORI 17 NOV)
EPOCH                                                                 (01
640702817,1956000
PROBE POSITION AND VELOCITY AT EPOCH                                  (02
X=-.48336203E4,Y=-.42062278E4,Z=-.14413927E4
DX=.70601156E1,DY=-.68713167E1,DZ=-.47795962E1
OTHER PARAMETER VALUES                                                (03
KE=.39860128E6,RE=.63783173E4,GMMOON=.38917128E0
KM=.49026712E4,RI(1)=.63757069E4,LO(1)=.27705399E2
RI(3)=.63719898E4,LA(3)=.35118806E2,LO(3)=.24319449E3
RI(4)=.63725939E4,LA(4)=-.31211947E2,LO(4)=.13688761E3
RI(5)=.63754893E4,LO(5)=.27685391E2
ARMOON=3.567,MSMOON=374.1
RSTOP=1735.6
ESTIMATE THESE PARAMETERS                                             (04
X,Y,Z,DX,DY,DZ,KE,RE,G,KM,RI(1),LO(1)
RI(3),LA(3),LO(3),RI(4),LA(4),LO(4),RI(5),LO(5)
COVARIANCE MATRIX OF ESTIMATED PARAMETERS                             (10
R01  2346705720602017501612O6/8   6347430444546014671106646/8  $
       6345066471746015673253222/8   2226741674341673401504446/8  $
       2226536712531676144750l2/8   2214663132651666770511124/8  $
       2066732310441532330134548/8   1756314731551425710114608/8  $
       5736526746615405676702268/8   2024264564741477317144568/8  $
       4000000000004300000000008/8   4000000000004000000000008/8  $
       5715224666645365577113548/8   5614703527615260155642468/8  $
       1707023013631350377725328/8   1745360733301411127123368/8  $
       1647116761671310704365008/8   1714354376441364557043268/8  $
       5754465005565427127574728/8   1714227752761361460601328/8  $
R02  6347430444546014671106528/8   2354263511702021317500708/8  $
       2345644261672010451667628/8   6227547471145676233774248/8  $
       6227562423565674300243468/8   6215570064245667303330648/8  $
       6066611447065537634517128/8   5754117334335420374635048/8  $
       1714253635051360571566768/8   6016361716575463436465548/8  $
       0000000000000000000000008/8   0000000000000000000000008/8  $
       1724564056601376442455428/8   1625474337541273560432308/8  $
       5705610423425357300625548/8   5725325735251537157337228/8  $
       5634200267735303523307668/8   5706375253445357752776048/8  $
       1755060626001424122057028/8   5706374151065350572715148/8  $
R03  6345066471746015673253248/8   2345644261672010451667628/8  $
       2337651716302006303746328/8   6225142262415671075674508/8  $
       6225141556075676501744768/8   6207362032515652366721108/8  $
       6064332310665531520770108/8   5746232666275416463434128/8  $
       1714465675771363332771008/8   6014172122635465522436108/8  $
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       5626212111175274332354508/8   5704076530605357073100528/8  $
       1746260670601414673220068/8   5704074213025355740620048/8  $
R04  2226741674341673401504468/8   6227547471145676233774228/8  $
       6225142262415671075674468/8   2107011421171556112406128/8  $
       2106641674441556626550328/8   2075004517601547023676668/8  $
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       1527360016731173312257508/8   1574273456231246411665548/8  $
       5634417225705307762560068/8   1574154331261243767735008/8  $
R05  2226536712531676144750148/8   6227562423565674300243448/8  $
       6225141556075676501745028/8   2106641674441556626550378/8  $
       2106723610621557706460368/8   2074731463231544766544628/8  $
       1745374532001417101370408/8   1617575250401263707422208/8  $
       1556066722071220513676448/8   1674140244741347300576128/8  $
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       1564371056071232666655048/8   5614663423445260322513508/8  $
       5515444264115161310507668/8   1564254132321237305747028/8  $
       5634627307775305632505448/8   1564374123631232324155248/8  $
R06  2214663132651666770511308/8   6215570064245667303330708/8  $
       6207362032515652366721168/8   2075004517601547023677728/8  $
       2074731463231544766544708/8   2064250671531537166727348/8  $
       1735013143711401522240008/8   1634046224641302533134768/8  $
       5574051717575245073724568/8   1667437404221332252267168/8  $
       0000000000000000000000008/8   0000000000000000000000008/8  $
       1605613466311251346755048/8   5514271561215161365020148/8  $
       1547740130371212461107508/8   1626206102721277605165528/8  $
       1534103127611206664674528/8   1556521633371220502617628/8  $
       5604745034245254314251628/8   1556202315021224300655108/8  $
R07  2066732310441532330134568/8   6066611447065537634517148/8  $
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       5764737671756543340103668/8   1715540657551363601542348/8  $
R08  1756314731551425710114628/8   5754117334335420374635068/8  $
       5746232666275416463434168/8   1636405164261304264276268/8  $
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       1744555661321414401647208/8   1704106404221351170467368/8  $
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       5615520223445264576065268/8   1667054775011333041031708/8  $
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       1666611074041334451176068/8   5614113436666526150056328/8  $
R09  5736526746661540567670230/8   1714253635051360571566768/8  $
       1714465675771363332771008/8   5615512403175261655746648/8  $
       1554066722071220513676648/8   5574051717575245073724568/8  $
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R10  2024264564741477317144568/8   6016361716575463436465568/8  $
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          4000C000000004000C000C000/8  0000000000000000000000000/8  $
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          1557032142561223073534268  5604453310215256621513168  $
          1655244110561323645262548  5604427035745254247242628  $
     R14  5614703527615260155642428  1625474337541273560432248  $
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     R18  1714354376441364557043268  5706375253445357752776048  $
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     R19  5754465005565427127574728  1755060262001426122057028  $
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     R20  1714227752761361460601328  5706374151065350572715168  $
          5704074213025355740620048  1574154331261243767735028  $
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          5615642004615261477064628  1554264137651222073456348  $
     STATISTICS,PLOT AND/OR PRINT RESIDUALS FOR THESE PARAMETERS        (14
     NHR=6.
     CC3(1)=1.,CC3(3)=.2,CC3(4)=.2,CC3(5)=.2
     MAP COVARIANCE MATRIX TO                                           (24
     6407029I0.2758000
     REJECTION SIGMAS                                                   (06
     CC3(1)=.4,CC3(3)=.04,CC3(4)=.04,CC3(5)=.04
     END DATA                                                           (0
ODP       141320
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INPUT COVARIANCE MATRIX OF ESTIMATED PARAMETERS ITERATION NUMBER 2

	X	Y	Z	DX	DY	DZ	KE	RE	G
X	.46676934-02	-.63087476-02	.30665630-03	.20865102-05	.10957090-04	-.13377595-04	.56456109-01	-.13415488-02	.91080736-03
Y	-.63087476-02	.11822721-01	.49678432-02	-.31038938-05	-.23569263-04	.24965882-04	-.11117888 00	.88517815-03	-.12049297-02
Z	.30665630-03	.49870432-02	.22534963-01	-.24311760-06	-.28653484-04	.23598630-04	.34652169-01	-.22597131-02	-.16943380-02
DX	.20865102-05	-.31038938-05	-.24311760-06	.58099729-08	-.65890229-08	.19019268-07	.20518082-06	.79253761-06	.24800145-05
DY	.10957090-04	-.23569563-04	-.28653484-04	-.65890229-08	.10423920-06	-.13903705-06	.16663998-03	-.41969746-05	.29608268-06
DZ	-.13377595-04	.24965882-04	.23598630-04	.19019268-07	-.13903705-06	.21443783-06	-.26891548-03	.93401898-05	.45701412-05
KE	.56456109-01	-.11117888 00	.34652169-01	.20518082-06	.16663998-03	-.26891548-03	.23466082 01	-.11756855-01	.65222888-02
RE	-.13415488-02	.88517815-03	-.22597131-02	.79253761-06	-.41969746-05	.93401898-05	-.11756855-01	.13176811-02	.97053817-04
G	.91080736-03	-.12049297-02	-.16943380-02	.24800145-05	.29608268-06	.45701412-05	.65222888-02	.97053817-04	.89775804-01
KM	.41849508-02	-.51820341-02	.11876436-02	.46625541-05	.10619567-04	-.88610182-05	.13444779-01	-.21378173-02	.44423186-02
RI(01)	-.11445711-02	.82405724-02	.38666686-01	.79732656-05	-.78117403-04	.97393593-04	.56005842-01	.40655052-04	-.93209908-03
LO(01)	.61320208-04	-.12791367-03	-.16810518-03	.32253077-07	.36661292-06	-.35540044-06	.59358992-03	.39362467-06	.21208975-04
RI(03)	-.36720541-03	.38529705-03	-.41985915-03	.40268669-06	-.15549465-05	.33185460-05	-.96136495-02	.24053120-03	.32122356-04
LA(03)	.23237375-05	-.38391167-05	.12565886-05	.20216093-08	.84421517-08	-.87658153-08	.15511635-04	-.15129767-05	-.28030477-07
LO(03)	.27390807-04	-.25682645-04	.36896843-04	-.73156275-08	.87147366-07	-.16881314-06	.31833730-03	-.20314357-04	.30283318-05
RI(04)	.88762630-03	-.12363649-02	-.72374851-03	.23089987-05	-.33308331-05	.93989067-05	-.20067602-01	.29437134-03	.98854520-04
LA(04)	-.23030735-04	.44181717-04	.20075123-04	-.20246364-07	-.54395164-07	.20291444-07	-.78960628-04	.26222348-05	.18060642-05
LO(04)	.25573690-04	-.20541226-04	.32531330-04	-.58022100-08	.85455216-07	-.16118294-06	.15858770-03	-.20564655-04	.44904227-05
RI(05)	-.35569632-03	.42648140-03	.96525658-03	.54354405-06	-.43326424-05	.64322882-05	.55662455-02	.36460036-03	.81792080-04
LO(05)	.26213165-04	-.24786836-04	.32424685-04	-.55496605-08	.89205301-07	-.16453891-06	.24824272-03	-.19920241-04	.45782705-05

	KM	RI(01)	LO(01)	RI(03)	LA(03)	LO(03)	RI(04)	LA(04)	LO(04)
X	.41849508-02	-.11445711-02	.61320208-04	-.36720541-03	.23237375-05	.27390807-04	.88762630-03	-.23030735-04	.25573690-04
Y	-.51820341-02	.82405724-02	-.12791367-03	.38529705-03	-.38391167-05	-.25682645-04	-.12363649-02	.44181717-04	-.20541226-04
Z	.11876436-02	.38666686-01	-.16810518-03	-.41985915-03	.12565886-05	.36896843-04	-.72374851-03	.20075123-04	.32531330-04
DX	.46625541-05	.79732656-05	.32253077-07	.40268669-06	.20216093-08	-.73156275-08	.23089987-05	-.20246364-07	-.58022100-08
DY	.10619567-04	-.78117403-04	.36661292-06	-.15549465-05	.84421517-08	.87147366-07	-.33308331-05	-.54395164-07	.85455216-07
DZ	-.88610182-05	.97393593-04	-.35540044-06	.33185460-05	-.87658153-08	-.16881314-06	.93989067-05	.20291444-07	-.16118294-06
KE	.13444779-01	.56005842-01	.59358992-03	-.96136495-02	.15511635-04	.31833730-03	-.20067602-01	-.78960628-04	.15858770-03
RE	-.21378173-02	.40655052-04	.39362467-06	.24053120-03	-.15129767-05	-.20314357-04	.29637134-03	.26222348-05	-.20564655-04
G	.44423186-02	-.93209908-03	.21208975-04	.32122356-04	-.28030477-07	.30283318-05	.98854520-04	.18060642-05	.44904227-05
KM	.27867872-01	-.29794299-03	.47832111-04	.72965669-04	.46098998-05	.49511998-04	-.37928930-03	-.29473070-05	.55280162-04
RI(01)	-.29794299-03	.10215893 00	-.32847926-03	.33023606-03	.87859539-06	.15917748-05	.29122335-02	.46837614-05	-.91076168-05
LO(01)	.47832111-04	-.32847926-03	.21840256-05	-.14112595-05	.23195501-07	.76158143-07	.17467830-04	-.47560252-06	.77390844-07
RI(03)	.72965669-04	.33023606-03	-.14112595-05	.33793952-02	.41481397-04	-.38096937-05	.11757213-03	.49215898-06	-.36916576-05
LA(03)	.46098998-05	.87859539-06	.23195501-07	.41481397-04	.54581121-06	.33394822-07	-.62987767-06	-.73468802-08	.30306275-07
LO(03)	.49511998-04	.15917748-05	.76158143-07	-.38096937-05	.33394822-07	.36998726-06	-.58726025-05	-.47321688-07	.37187720-06
RI(04)	-.37928930-03	.29122335-02	.17467830-04	.11757213-03	-.62987767-06	-.58726025-05	.33416988-02	-.34445032-04	-.78029577-05
LA(04)	-.29473070-05	.46837614-05	-.47560252-06	.49215589-06	-.73468802-08	-.47321688-07	-.34445032-04	.59819424-06	-.46650311-07
LO(04)	.55280162-04	-.91076168-05	.77390844-07	-.36916576-05	.30306275-07	.37187720-06	-.78029577-05	-.46650311-07	.41264785-06
RI(05)	-.54625306-03	.38131554-02	-.11244886-04	.63236329-04	-.42187665-06	-.52529267-05	.11326376-03	.18912372-05	-.67226871-06
LO(05)	.53241117-04	-.48407862-05	.93330992-07	-.42475682-05	.28521318-07	.36937504-06	-.50296643-05	-.51643106-07	.37077124-06

	RI(05)	LO(05)
X	-.35569632-03	.26213165-04
Y	.42648140-03	-.24786836-04
Z	.96525658-03	.32424685-04
DX	.54354405-06	-.55496605-08
DY	-.43326424-05	.89205301-07
DZ	.64322882-05	-.16453891-06
KE	.55662455-02	.24824272-03
RE	.36460036-03	-.19920241-04
G	.81792080-04	.45782705-05
KM	-.54625306-03	.53241117-04
RI(01)	.38131554-02	-.48407862-05
LO(01)	-.11244886-04	.93330992-07
RI(03)	.63236329-04	-.42475682-05
LA(03)	-.47187665-06	.28521318-07
LO(03)	-.57479267-05	.36937504-06
RI(04)	.11326374-03	-.50296643-05
LA(04)	.18912372-05	-.51643106-07
LO(04)	-.67422871-06	.37077124-06
RI(05)	.64990034-03	-.62438005-05
LO(05)	-.62438005-05	.38166246-06

INPUT J MATRIX OF ESTIMATED PARAMETERS ITERATION NUMBER 2

	X	Y	Z	DX	DY	DZ	KE	RE	G
X	.70439461 06	.66951215 06	.22145379 06	-.72340650 09	.76453936 09	.52602138 09	.17250279 05	-.44340735 05	-.10584178 04
Y	.66951215 06	.63738628 06	.21125280 06	-.68721516 09	.72789247 09	.50050512 09	.16417572 05	-.44424289 05	-.10027204 04
Z	.22145379 06	.21125280 06	.70466720 05	-.22708761 09	.24140775 09	.16577199 09	.54385871 04	-.15246610 05	-.32960638 03
DX	-.72340650 09	-.68721516 09	-.22708761 09	.74308054 12	-.78470504 12	-.54002860 12	-.17708367 08	.44823116 08	.10883369 07
DY	.76453936 09	.72789247 09	.24140775 09	-.78470504 12	.83232501 12	.57156453 12	.18748230 08	-.50614119 08	-.11445530 07
DZ	.52602138 09	.50050512 09	.16577199 09	-.54002860 12	.57156453 12	.39309363 12	.12893164 08	-.34292320 08	-.78869472 06
KE	.17250279 05	.16417572 05	.54385871 04	-.17708367 08	.18748230 08	.12893164 08	.42294925 03	-.11391668 04	-.25844524 02
RE	-.44340735 05	-.44424289 05	-.15246610 05	.44823116 08	-.50614119 08	-.34292320 08	-.11391668 04	.10751322 05	.65679357 02
G	-.10584178 04	-.10027204 04	-.32960638 03	.10883369 07	-.11445530 07	-.78869472 06	-.25844524 02	.65679357 02	.12762760 02
KM	-.83585161 04	.80745526 04	-.27211563 04	.85385783 07	-.92237737 07	-.63091906 07	-.20786183 03	.63575402 03	.10550591 02
RI(01)	.00000000 00	.00000000 00	.00000000 00	-.00000000 00	.00000000 00	.00000000 00	.00000000 00	-.00000000 00	-.00000000 00
LO(01)	.00000000 00	.00000000 00	.00000000 00	-.00000000 00	.00000000 00	.00000000 00	.00000000 00	-.00000000 00	-.00000000 00
RI(03)	.28947720 05	.28737681 05	.10807712 05	-.29089154 08	.33274590 08	.22251632 08	.73116410 03	-.31477321 04	-.35363159 02
LA(03)	-.23706185 07	-.23503166 07	-.87862650 06	.23843644 10	-.27191586 10	-.18206453 10	-.59820561 05	.25747957 06	.29330355 04
LO(03)	.19998691 07	.18856750 07	.54512433 06	-.20756751 10	.23150742 10	.14851178 10	.48320916 05	-.69002128 05	-.32785764 04
RI(04)	.21331156 04	.18938105 04	.85131008 03	-.21669813 07	.23024349 07	.15239970 07	.50495185 02	.29572945 03	-.18306219 01
LA(04)	.13553201 06	.12053263 06	.54946868 05	-.13743085 09	.14689653 09	.96937391 08	.32130997 04	.18740661 05	-.11300043 03
LO(04)	.55127419 06	.44794824 06	.15242600 06	-.58419733 09	.62711194 09	.37234087 09	.12147258 05	.15842981 06	-.61728825 03
RI(05)	-.32575344 03	-.32153228 03	-.59048416 02	.34361006 06	-.34061053 06	-.24938103 06	-.71038137 01	-.10271707 03	.22288837 00
LO(05)	-.34799065 06	-.40157880 06	-.14169302 06	.33730302 09	-.45069449 09	-.29652312 09	-.10064553 05	.22946495 06	.61238970 03

	KM	RI(01)	LO(01)	RI(03)	LA(03)	LO(03)	RI(04)	LA(04)	LO(04)
X	-.83585161 04	.00000000 00	.00000000 00	.28947720 05	-.23706185 07	.19982691 07	.21331156 04	.13553201 06	.55127419 06
Y	-.80745526 04	.00000000 00	.00000000 00	.28737681 05	-.23503166 07	.18856750 07	.18938105 04	.12053263 06	.44794824 06
Z	-.27211563 04	.00000000 00	.00000000 00	.10807712 05	-.87862650 06	.54512433 06	.85131008 03	.54946868 05	.15242600 06
DX	.85385783 07	-.00000000 00	-.00000000 00	-.29089154 08	.23843644 10	-.20756751 10	-.21669813 07	-.13743085 09	-.58419733 09
DY	-.92237737 07	.00000000 00	.00000000 00	.33274590 08	-.27191586 10	.23150742 10	.23024349 07	.14689653 09	.62711194 09
DZ	-.63091906 07	.00000000 00	.00000000 00	.22251632 08	-.18206453 10	.14851178 10	.15239970 07	.96937391 08	.37234087 09
KE	-.20786183 03	.00000000 00	.00000000 00	.73116410 03	-.59820561 05	.48320916 05	.50495185 02	.32130997 04	.12147258 05
RE	.63575402 03	-.00000000 00	-.00000000 00	-.31477321 04	.25747957 06	-.69002128 05	.29572945 03	.18740661 05	.15842981 06
G	.10550591 02	-.00000000 00	-.00000000 00	-.35363159 02	.29330355 04	-.32785764 04	-.18306219 01	-.11300043 03	-.61728825 03
KM	.17777102 03	-.00000000 00	-.00000000 00	-.67082535 03	.53609304 05	-.25182991 05	-.37566750 02	-.24269779 04	-.79137475 04
RI(01)	-.00000000 00	.48835752 01	.19615516-05	.60000000 00	-.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00
LO(01)	-.00000000 00	.19615516-05	.40163013 05	.00000000 00	-.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00
RI(03)	-.67082535 03	.00000000 00	.00000000 00	.12603803 05	-.96381546 06	.29046021 05	-.69689682 01	-.45938110 03	-.26902512 04
LA(03)	.53609304 05	-.00000000 00	-.00000000 00	-.96381546 06	.76763545 08	-.30164232 07	.18757040 04	.12294051 06	.50487974 06
LO(03)	-.25182991 05	.00000000 00	.00000000 00	.29046021 05	-.30164232 07	.55359049 08	-.71253333 05	-.46383645 07	-.15711554 08
RI(04)	-.37566750 02	.00000000 00	.00000000 00	-.69689682 01	.18757040 04	-.71253333 05	.10952116 04	.66191537 05	.84611318 05
LA(04)	-.24269779 04	.00000000 00	.00000000 00	-.45938110 03	.12294051 06	-.46583645 07	-.66191537 05	.56412546 07	.54366824 07
LO(04)	-.79137475 04	.00000000 00	.00000000 00	-.26902512 04	.50487974 06	-.15711554 08	.84611318 05	.54366824 07	.29939407 08
RI(05)	.77565716 00	-.00000000 00	-.00000000 00	.60562039 01	-.14605003 03	-.18031964 05	-.10736919 02	-.70194721 03	-.23304895 04
LO(05)	.41366241 04	-.00000000 00	-.00000000 00	-.56900229 04	.75987527 06	-.16492817 08	-.12676213 05	-.82803253 06	-.28910342 07

	RI(05)	LO(05)
X	-.32575344 03	-.34799065 06
Y	-.32153228 03	-.40157880 06
Z	-.59048416 02	-.14169302 06
DX	.34361006 06	.33730302 09
DY	-.34061053 06	-.45069449 09
DZ	-.24938103 06	-.29652312 09
KE	-.71038137 01	-.10064553 05
RE	-.10271707 03	.22946495 06
G	.22288837 00	.61238970 03
KM	.77565716 00	.41366241 04
RI(01)	-.00000000 00	-.00000000 00
LO(01)	-.00000000 00	-.00000000 00
RI(03)	.60562039 01	-.56900229 04
LA(03)	-.14605003 03	.75987527 06
LO(03)	-.18031964 05	-.16492817 08
RI(04)	-.10736919 02	-.12676213 05
LA(04)	-.70194721 03	-.82803253 06
LO(04)	-.23304895 04	-.28910342 07
RI(05)	.80827325 03	.24437395 05
LO(05)	.24437395 05	.32143284 08

CASE 1 SPACE TRAJECTORIES 1

EPHEMERIS TAPE IV WITH MARS VELOCITIES. B-8 IS

GME	.39860146 06	J	.162345CC-02	H	-.57499999-05	D	.78749999-05	RE	.63781650 04	REM	.63783098 04
G	.66709998-19	A	.08782497 29	B	.88800499 29	C	.88837498 29	OME	.41780741-02	AU	.14959900 09
GMM	.49026944 04	GMS	.13271544 12	GMV	.32476952 06	GMA	.42977799 05	GMC	.37918700 08	GMJ	.12671062 09
EGM	.39860320 06	MGM	.49027779 04	JA	.29200000-02	HA	.00000000 00	DA	.00000000 00	RA	.34170000 04
ARA	.35670000 01	GB	.38362165 00	MAS	.37410000 03	GB1	.00000000 00	GB2	.00000000 00	SC	.10200000 09

INJECTION CONDITIONS MOON 2356664502572020000000000 J.D.= 2438605.22217592 JULY 28,1964 17 19 56.000

GEOCENTRIC XO-.48336127 04 YO-.42062469 04 ZO-.14413982 04 DXO .70601055 01 DYO-.68712140 01 DZO-.47797493 01
CARTESIAN GMC .CCOOCOCO OC SGC .OOOOOOOO OO TO .62396000 05 GHA .20638174 03 GHO .30568662 03
DATE OF RUN 111764A 000000 EARTH IS THE CENTRAL BODY FOR INTEGRATION COWELL EQUATIONS OF MOTION

0 DAYS 0 HRS. 0 MIN. 0.000 SEC. 2356664502572020000000000 J.D.= 2438605.22217592 JULY 28,1964 17 19 56.000

GEOCENTRIC EQUATORIAL COORDINATES

X	-.48336126 04	Y	-.42062467 04	Z	-.14413981 04	DX	.70601052 01	DY	-.68712138 01	DZ	-.47797492 01
R	.65676442 04	DEC	-.12677880 02	RA	.22103004 03	V	.10950099 02	PTH	.13272048 01	AZ	.11625195 03
R	.65676440 04	LAT	-.12677881 02	LON	.14648304 02	VE	.10533192 02	PTE	.13797452 01	AZE	.11737655 03
XS	-.88492690 08	YS	.11325740 09	ZS	.49113300 08	DXS	-.23722515 02	DYS	-.15814255 02	DZS	-.68579680 01
XM	.38246583 06	YM	-.36198953 05	ZM	-.50845669 05	DXM	.82773605-01	DYM	.93298925 00	DZM	.39361316 00
XT	.38246583 06	YT	-.36198953 05	ZT	-.50845669 05	DXT	.82773605-01	DYT	.93298925 00	DZT	.39361316 00
RS	.15188914 09	VS	.29323712 02	RM	.38701081 06	VM	.10159979 01	RT	.38701081 06	VT	.10159979 01
GED	-.12761458 02	ALT	.19047778 03	LOS	.28162025 03	RAS	.12800198 03	RAM	.35548537 03	LOM	.14910364 03
DUT	.35000000 02	DT	.37500000 01	DR	.25362648 00	SHA	.65203966 04	DES	.18865618 02	DEM	-.75493738 01
DAC	.00000000 00	CCL	.81704560 02	MCL	.18380597 03	TCL	.18380597 03				

GEOCENTRIC CONIC

EPOCH OF PERICENTER PASSAGE 2356664502472027604315 50 J.D.= 2438605.22185045 JULY 28,1964 17 19 27.879

SMA	.26955725 06	ECC	.97564866 00	B	.59124471 05	SLR	.12968310 05	APO	.53255040 06	RCA	.65640768 04
VH	.13500517 00	C3	-.14787266 01	C1	.71897060 05	TFP	.28120701 02	TF	-.78113059-02	PER	.23213236 05
TA	.26875432 01	MTA	.00000000 00	EA	.29842718 00	MA	.72684483-02	C3J	-.18712425 01	TFI	.00000000 00

ALL VECTORS REFERENCED TO EARTH EQUATOR PLANE

X	-.48336126 04	Y	-.42062467 04	Z	-.14413981 04	DX	.70601052 01	DY	-.68712138 01	DZ	-.47797492 01
INC	.28956008 02	LAN	.17040877 02	APF	.20426936 03	MX	.66197685 00	MY	-.61283272 00	MZ	-.43153523 00
WX	.14187853 00	WY	-.46288231 00	WZ	.87499167 00	PX	-.76620368 00	PY	-.61101013 00	PZ	-.19899382 00
CX	.62673950 00	CY	-.64218888 00	CZ	-.44135136 00	RX	.15558130 00	RY	.12406851 00	RZ	-.98000074 00
BX	-.62673951 00	BY	.64218888 00	BZ	.44135136 00	TX	-.62347925 00	TY	.78183989 00	TZ	.00000000 00
DAP	-.11478126 02	RAP	.21857066 03								
BTQ	.52789164 05	BRQ	-.26627190 05	B	.59124471 05	THA	.33323333 03				

HELIOCENTRIC EQUATORIAL COORDINATES

X	.88487856 08	Y	-.11326160 09	Z	-.49114741 08	DX	.30782620 02	DY	.89430408 01	DZ	.20782188 01
R	.15188993 09	LAT	-.18866090 02	LON	.30799943 03	V	.32122681 02	PTH	.19253932 02	AZ	.78943390 02
XE	.88492690 08	YE	-.11325740 09	ZE	-.49113300 08	DXE	.23722515 02	DYE	.15814255 02	DZE	.68579680 01
XT	.88875155 08	YT	-.11328760 09	ZT	-.49164145 08	DXT	.23805288 02	DYT	.16747244 02	DZT	.72515811 01
LTE	-.18865618 02	LOE	.30800198 03	LTT	-.18852131 02	LOT	.30811451 03	RST	.15215119 09	VST	.29995789 02
EPS	.83120794 02	ESP	.27453512-18	SEP	.96876744 02	EPM	.48837764 02	EMP	.73205182 00	MEP	.13043020 03
MPS	.13183428 03	MSP	.10992114 00	SMP	.48055927 02	SEM	.13256592 03	EMS	.47326739 02	ESM	.10698938 00
RPM	.39130200 06	SPN	.69231538 01								
SAC	.58302418-10										
GCE	.27829544 03	GCT	.28210141 03	SIP	.13157979 03	CPT	.90011781 02	SIN	.89757295 02	D1	.13324878 00
REP	.65676442 04	VEP	.10950099 02	CPE	.80398066 02	CPS	.76802219 02	D2	.89358467-01	D3	.53185111-03

CASE 1 SPACE TRAJECTORIES 2

0 DAYS 16 HRS. 54 MIN. 36.000 SEC. 2356665060422020000000000 J.D.= 2438605.92675926 JULY 29,1964 10 14 32.000

GEOCENTRIC EQUATORIAL COORDINATES

X	.15549425 06	Y	.62245145 05	Z	.78473311 04	DX	.14697794 01	DY	.99202382 00	DZ	.28791905 00
R	.16767379 06	DEC	.26824884 01	RA	.21816481 02	V	.17964577 01	PTH	.76221015 02	AZ	.61145263 02
R	.16767379 06	LAT	.26824893 01	LON	.28109027 03	VE	.11968473 02	PTE	.83824255 01	AZE	.27099923 03
XS	-.89930662 08	YS	.11228674 09	ZS	.48692392 08	DXS	-.23518788 02	DYS	-.16074298 02	DZS	-.69705388 01
XM	.38253037 06	YM	.26705007 05	ZM	-.26342825 05	DXM	-.81249022-01	DYM	.93247216 00	DZM	.40971036 00
XT	.38253037 06	YT	.26705007 05	ZT	-.26342825 05	DXT	-.81249022-01	DYT	.93247216 00	DZT	.40971036 00
RS	.15187753 09	VS	.29327543 02	RM	.38436517 06	VM	.10217477 01	RT	.38436517 06	VT	.10217477 01
GED	.27007429 01	ALT	.16129563 06	LOS	.27965097 02	RAS	.12869130 03	RAM	.39934220 01	LOM	.26326722 03
DUT	.35000000 02	DT	.48000000 03	DR	.17447587 01	SHA	.16192291 06	DES	.18699395 02	DEM	-.39298996 01
DAC	.00000000 00	CCL	.25839182 03	MCL	.91099353-01	TCL	.91099353-01				

GEOCENTRIC CONIC

EPOCH OF PERICENTER PASSAGE 2356664502552026242000 00 J.D.= 2438605.22211988 JULY 28,1964 17 19 51.158

SMA	.26099681 06	ECC	.97494844 00	B	.58053777 05	SLR	.12912957 05	APO	.51545525 06	RCA	.65383769 04
VH	.13918464 00	C3	-.15272273 01	C1	.71743458 05	TFP	.60880841 05	TF	-.13449192-02	PER	.22116275 05
TA	.16120973 03	MTA	.00000000 00	EA	.68484586 02	MA	.16516572 02	C3J	-.19367272 01	TFI	.16910000 02

ALL VECTORS REFERENCED TO EARTH EQUATOR PLANE

X	.15549425 06	Y	.62245145 05	Z	.78473311 04	DX	.14697794 01	DY	.99202382 00	DZ	.28791905 00
INC	.28968483 02	LAN	.16961500 02	APF	.20433545 03	MX	-.34646309 00	MY	.80472331 00	MZ	.48206178 00
WX	.14129286 00	WY	-.46326051 00	WZ	.87488624 00	PX	-.76633964 00	PY	-.61064791 00	PZ	-.19958125 00
CX	.62670557 00	CY	-.64226064 00	CZ	-.44129495 00	RX	.15608730 00	RY	.12437616 00	RZ	-.97988126 00
BX	-.62670562 00	BY	.64226069 00	BZ	.44129499 00	TX	-.62318560 00	TY	.78207397 00	TZ	.00000000 00
DAP	-.11512473 02	RAP	.21854914 03								
BTQ	.51833274 05	BRQ	-.26144841 05	B	.58053777 05	THA	.33323350 03				

HELIOCENTRIC EQUATORIAL COORDINATES

X	.90086156 08	Y	-.11222450 09	Z	-.48684544 08	DX	.24988567 02	DY	.17066321 02	DZ	.72584578 01
R	.15192115 09	LAT	-.18690701 02	LON	.30875511 03	V	.31118692 02	PTH	-.21221398 00	AZ	.75819031 02
XE	.89930662 08	YE	-.11228674 09	ZE	-.48692392 08	DXE	.23518788 02	DYE	.16074298 02	DZE	.69705388 01
XT	.90313192 08	YT	-.11226004 09	ZT	-.48718734 08	DXT	.23437539 02	DYT	.17006770 02	DZT	.73802492 01
LTE	-.18699395 02	LOE	.30869130 03	LTT	-.18682388 02	LOT	.30881668 03	RST	.15209308 09	VST	.29883381 02
EPS	.74889462 02	ESP	.60570802-01	SEP	.10504947 03	EPM	.14741079 03	EMP	.13589370 02	MEP	.18999835 02
MPS	.13769965 03	MSP	.58923450-01	SMP	.42241441 02	SEM	.12404926 03	EMS	.55830766 02	ESM	.12012787 00
RPM	.23233052 06	SPN	.72709513 02								
SAC	.58278449-10										
GCE	.10160817 03	GCT	.28169927 03	SIP	.13727103 03	CPT	.92006943 02	SIN	.91578325 02	D1	.22442794 00
REP	.16767379 06	VEP	.17964577 01	CPE	.97469657 02	CPS	.76876923 02	D2	.16698327 00	D3	.18489126-02

J MATRIX — ITERATION NUMBER 3

	X	Y	Z	DX	DY	DZ	KE	RE	G
X	.19104955 08	.16741708 08	.59542163 07	-.19724787 11	.19580438 11	.13524258 11	.41072193 06	-.41785439 05	-.70417674 04
Y	.16741708 08	.14740618 08	.52516733 07	-.17312694 11	.17205844 11	.11877047 11	.36100596 06	-.42178537 05	-.62519864 04
Z	.59542163 07	.52516733 07	.18756168 07	-.61684432 10	.61289405 10	.42301119 10	.12847413 06	-.14450799 05	-.22009443 04
DX	-.19724787 11	-.17312694 11	-.61684432 10	.20413436 14	-.20249107 14	-.13982117 14	-.42466946 09	.42186699 08	.72666978 07
DY	.19580438 11	.17205844 11	.61289405 10	-.20249107 14	.20107456 14	.13884666 14	.42171913 09	-.47999416 08	-.72732084 07
DZ	.13524258 11	.11877047 11	.42301119 10	-.13987117 14	.13884666 14	.95889284 13	.29118683 09	-.32486894 08	-.50196711 07
KE	.41072193 06	.36100596 06	.12847413 06	-.42446946 09	.42171913 09	.29118683 09	.88525864 04	-.10838895 04	-.15440243 03
RE	-.41785439 05	-.42178537 05	-.14450799 05	.42186699 08	-.47999416 08	-.32486894 08	-.10838895 04	.10751783 05	.64789592 02
G	-.70417674 04	-.62519864 04	-.22009443 04	.72664978 07	-.72732084 07	-.50196711 07	-.15440243 03	.64789592 02	.14752715 02
KM	-.93393917 04	-.89366157 04	-.30266983 04	.95505702 07	-.10227508 08	-.70022392 07	-.22907701 03	.63557829 03	.10891683 02
RI(01)	-.53585128 04	.40903715 04	.31234708 04	-.83873558 06	.11865393 07	.16862749 06	.12280107 01	-.46346797 04	-.58973265-02
LO(01)	-.26963463 07	.19656292 07	.16112827 07	-.43386368 09	.58713906 09	.40016812 09	.60269080 03	-.24069296-01	-.30424697 01
RI(03)	.12964530 06	.11682776 06	.41575969 05	-.13323175 09	.13566611 09	.93138268 08	.29161051 04	-.32747790 08	-.71195455 02
LA(03)	-.97958612 07	-.88458727 07	-.31473749 07	.10026351 11	-.10269260 11	-.70476680 10	-.22093303 06	.25578681 06	.55750958 04
LO(03)	-.28749460 07	-.23843494 07	-.85258858 06	.29611781 10	-.28501122 10	-.19492803 10	-.57581661 05	.70160617 05	-.15171494 04
RI(04)	-.48853299 05	-.44438734 05	-.15151588 05	.45433924 08	-.48279614 08	-.32749790 08	-.10093035 04	.29321792 03	.12644031 02
LA(04)	.86839483 05	-.33303468 06	-.13233844 05	-.76865591 09	.19445543 09	.24790506 09	-.13958388 04	.18624825 05	.17216734 03
LO(04)	-.32107281 07	-.33059756 07	-.11006488 07	.23593546 10	-.31475387 10	-.20067423 10	-.67400436 05	.15824625 06	.52188814 03
RI(05)	-.92774377 04	-.83517887 04	-.28621494 04	.97198157 07	-.96293478 07	-.67651372 07	-.23003110 03	.11010822 03	.78564794 01
LO(05)	-.23627786 08	-.20988391 08	-.75550375 07	.24273069 11	-.24450178 11	-.16802039 11	-.51203701 06	.22668180 06	.83518659 04

	KM	RI(01)	LO(01)	RI(03)	LA(03)	LO(03)	RI(04)	LA(04)	LO(04)
X	-.93393917 04	-.53585128 04	-.26963463 07	.12964530 06	-.97958612 07	-.28749460 07	-.48853299 05	.86839483 05	-.32107281 07
Y	-.89366157 04	.40903715 04	.19656292 07	.11682776 06	-.88458727 07	-.23843494 07	-.44438734 05	-.33303468 06	-.33059756 07
Z	-.30266983 04	.31234708 04	.16112827 07	.41575969 05	-.31473749 07	-.85258858 06	-.15151588 05	-.13233844 05	-.11006488 07
DX	.95505702 07	-.83873558 06	-.43386368 09	-.13323175 09	.10026351 11	.29611781 10	.45433924 08	-.76865591 09	.23593546 10
DY	-.10227508 08	.11865393 07	.58713906 09	.13566611 09	-.10269260 11	-.28501122 10	-.48279614 08	.19445543 09	-.31475387 10
DZ	-.70022392 07	.16862749 06	.40016812 09	.93138268 08	-.70476680 10	-.19492803 10	-.32749790 08	.24790506 09	-.20067423 10
KE	-.22907701 03	.12280107 01	.60269080 03	.29161051 04	-.22093303 06	-.57581661 05	-.10093035 04	-.13958388 04	-.67400436 05
RE	.63557829 03	-.46346797-04	-.24069294-01	-.31247451 04	.25578681 06	-.70160617 05	.29321792 03	.18624825 05	.15824625 06
G	.10891683 02	-.58973265-02	-.30424697 01	-.71195455 02	.55750958 04	-.15171494 04	.12644031 02	.17216734 03	.52188814 03
KM	.17783807 03	.20204035-04	.10491105-01	-.67953910 03	.54251752 05	-.24744729 05	-.36557857 02	-.23808496 04	-.78394322 04
RI(01)	.20204035-04	.14764427 04	.49283580 06	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00
LO(01)	.10491105-01	.49283580 06	.34349497 09	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00
RI(03)	-.67953910 03	.00000000 00	.00000000 00	.14326128 05	-.11055974 07	-.58088714 05	-.69689682 01	-.45938110 03	-.26902512 04
LA(03)	.54251752 05	.00000000 00	.00000000 00	-.11055974 07	.87220782 08	.34037497 07	.18757040 04	.12294051 06	.50487974 06
LO(03)	-.24744729 05	.00000000 00	.00000000 00	-.58088714 05	.34037497 07	.60587237 08	-.71253333 05	-.46583645 07	-.15711554 08
RI(04)	-.36557857 02	.00000000 00	.00000000 00	-.69689682 01	.18757040 04	-.71253333 05	.38935705 04	.28563438 06	.44320791 06
LA(04)	-.23808496 04	.00000000 00	.00000000 00	-.45938110 03	.12294051 06	-.46583645 07	.28563438 06	.32211838 08	.40580919 08
LO(04)	-.78394322 04	.00000000 00	.00000000 00	-.26902512 04	.50487974 06	-.15711554 08	.44320791 06	.40580919 08	.89219720 08
RI(05)	.35506251 01	.00000000 00	.00000000 00	.60562039 01	-.14605003 03	-.18031964 05	-.10736919 02	-.70194721 03	-.23304895 04
LO(05)	.52162889 04	.00000000 00	.00000000 00	-.56900229 04	.75987527 06	-.16492817 08	-.12676213 05	-.82803253 06	-.28910342 07

	RI(05)	LO(05)
X	-.92774377 04	-.23627786 08
Y	-.83517887 04	-.20988391 08
Z	-.28621494 04	-.75550375 07
DX	.97198157 07	.24273069 11
DY	-.96293478 07	-.24450178 11
DZ	-.67651372 07	-.16802039 11
KE	-.23003110 03	-.51203701 06
RE	-.11010822 03	.22668180 06
G	.78564794 01	.83518659 04
KM	.35506251 01	.52162889 04
RI(01)	.00000000 00	.00000000 00
LO(01)	.00000000 00	.00000000 00
RI(03)	.60562039 01	-.56900229 04
LA(03)	-.14605003 03	.75987527 06
LO(03)	-.18031964 05	-.16492817 08
RI(04)	-.10736919 02	-.12676213 05
LA(04)	-.70194721 03	-.82803253 06
LO(04)	-.23304895 04	-.28910342 07
RI(05)	.29074216 04	.23801370 05
LO(05)	.23801370 05	.91078169 08

CORRELATIONS BASED ON J MATRIX — ITERATION NUMBER 3

	X	Y	Z	DX	DY	DZ	KE	RE	G
X	-.10000000 01	-.99762865 00	-.99467120 00	.99875736 00	-.99901225 00	-.99920688 00	-.99871091 00	.92195924-01	.41944275 00
Y	-.99762865 00	-.10000000 01	-.99877532 00	.99799296 00	-.99940048 00	-.99900927 00	-.99935879 00	.10594816 00	.42395934 00
Z	-.99467120 00	-.99877532 00	-.10000000 01	.99683710 00	-.99800976 00	-.99745835 00	-.99703074 00	.10176058 00	.41840901 00
DX	.99875736 00	.99799296 00	.99683710 00	-.10000000 01	.99941986 00	.99968656 00	.99846316 00	-.90044250-01	-.41870644 00
DY	-.99901225 00	-.99940048 00	-.99800976 00	.99941986 00	-.10000000 01	-.99993512 00	-.99956177 00	.10323267 00	.42229067 00
DZ	-.99920688 00	-.99900927 00	-.99745835 00	.99968656 00	-.99993512 00	-.10000000 01	-.99962822 00	.10117726 00	.42204062 00
KE	-.99871091 00	-.99935879 00	-.99703074 00	.99846316 00	-.99956177 00	-.99962822 00	-.10000000 01	.11109888 00	.42725097 00
RE	.92195924-01	.10594816 00	.10176058 00	-.90044250-01	.10323267 00	.10117726 00	.11109888 00	-.10000000 01	-.16267808 00
G	.41944275 00	.42395934 00	.41840901 00	-.41870644 00	.42229067 00	.42204062 00	.42725097 00	-.16267808 00	-.10000000 01
KM	.16022608 00	.17454317 00	.16572373 00	-.15850304 00	.17103260 00	.16956630 00	.18257195 00	-.45963856 00	-.21264083 00
RI(01)	.31903149-01	-.27724722-01	-.89350951-01	.48306773-02	-.68859813-02	-.14171167-02	-.33964824-03	.11631662-07	.39955959-04
LO(01)	.33284533-01	-.27623809-01	-.63480379-01	.51810022-02	-.70668379-02	-.17453571-02	-.34562033-03	.12524573-07	.42739564-04
RI(03)	-.24781029 00	-.25422824 00	-.25363309 00	.24635647 00	-.25277166 00	-.25129203 00	-.25894270 00	.25177346 00	.15486450 00
LA(03)	.23997148 00	.24670210 00	.24607440 00	-.23848784 00	.24521701 00	.24369713 00	.25142911 00	-.24613413 00	-.15541981 00
LO(03)	.84501828-01	.79785041-01	.89359913-01	-.84196614-01	.81656887-01	.80872092-01	.78624614-01	.86928580-01	.50745998-01
RI(04)	-.17912115 00	-.18549397 00	-.17730136 00	.17254850 00	-.17701456 00	-.17916566 00	-.17918456 00	-.45318575-01	-.52756447-01
LA(04)	-.35005514-02	-.15283536-01	-.17025748-02	.29974013-01	-.76407105-02	-.14105634-01	.26139209-02	-.31647849-01	-.78978166-02
LO(04)	.77767850-01	.91161477-01	.85083684-01	-.55281965-01	.76312535-01	.68608219-01	.74839802-01	-.16157076 00	-.14385038-01
RI(05)	.39364164-01	.40342949-01	.38758436-01	-.39895572-01	.39825780-01	.40517027-01	.45341665-01	.19693618-01	-.37934817-01
LO(05)	.56642560 00	.57281670 00	.57803938 00	-.56290902 00	.57134220 00	.56855149 00	.57024189 00	-.22907056 00	-.22784547 00

	KM	RI(01)	LO(01)	RI(03)	LA(03)	LO(03)	RI(04)	LA(04)	LO(04)
X	.16022608 00	.31903149-01	.33284533-01	-.24781029 00	.23997148 00	.84501828-01	.17912115 00	-.35005514-02	.77767850-01
Y	.17454317 00	-.27724722-01	-.27623809-01	-.25422824 00	.24670210 00	.79785041-01	.18549397 00	-.15283536-01	.91161477-01
Z	.16572373 00	-.89350951-01	-.63480379-01	-.25363309 00	.24607440 00	.89359913-01	.17730136 00	-.17025748-02	.85083684-01
DX	-.15850304 00	.48306773-02	.51810022-02	.24635647 00	-.23848784 00	-.84196614-01	-.16114873 00	.29974013-01	-.55281965-01
DY	.17103260 00	-.68859813-02	-.70668379-02	-.25277166 00	.24521701 00	.81656887-01	.17254850 00	-.76407105-02	.76312535-01
DZ	.16956630 00	-.14171167-02	-.17453571-02	-.25129203 00	.24369713 00	.80872092-01	.16949210 00	-.14105634-01	.68608219-01
KE	.18257195 00	-.33964824-03	-.34562033-03	-.25894270 00	.25142911 00	.78624614-01	.17918456 00	.26139209-02	.74839802-01
RE	-.45963856 00	.11631662-07	.12524573-07	.25177346 00	-.24613413 00	.86928580-01	-.45318575-01	-.31647849-01	-.16157076 00
G	-.21264083 00	.39955959-04	.42739564-04	.15486450 00	-.15541981 00	.50745998-01	-.52756447-01	-.78978166-02	-.14385038-01
KM	-.10000000 01	-.39426483-07	-.42447162-07	.42573335 00	-.43560355 00	.23838546 00	.43933352-01	.31456604-01	.62236020-01
RI(01)	-.39426483-07	-.10000000 01	-.97281984 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00
LO(01)	-.42447162-07	-.97281984 00	-.10000000 01	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00
RI(03)	.42573335 00	.00000000 00	.00000000 00	-.10000000 01	.98905990 00	-.62350044-01	.93310398-03	.67624015-03	.23795672-02
LA(03)	-.43560355 00	.00000000 00	.00000000 00	.98905990 00	-.10000000 01	-.46822764-01	-.32186985-02	-.23194087-02	-.57233132-02
LO(03)	.23838546 00	.00000000 00	.00000000 00	-.62350044-01	-.46822764-01	-.10000000 01	.14670354 00	.10544722 00	.21369685 00
RI(04)	.43933352-01	.00000000 00	.00000000 00	.93310398-03	-.32186985-02	.14670354 00	-.10000000 01	-.80654521 00	-.75197440 00
LA(04)	.31456604-01	.00000000 00	.00000000 00	.67624015-03	-.23194087-02	.10544722 00	-.80654521 00	-.10000000 01	-.75697878 00
LO(04)	.62236020-01	.00000000 00	.00000000 00	.23795672-02	-.57233132-02	.21369685 00	-.75197440 00	-.75697878 00	-.10000000 01
RI(05)	-.49378563-02	.00000000 00	.00000000 00	-.93838719-03	.29002647-03	.42963379-01	.31911825-02	.22937321-02	.45757545-02
LO(05)	-.40986622-01	.00000000 00	.00000000 00	.49812971-02	-.85256042-02	.22202257 00	.21286701-01	.15287360-01	.32071232-01

	RI(05)	LO(05)
X	.39364164-01	.56642560 00
Y	.40342949-01	.57281470 00
Z	.38758436-01	.57803938 00
DX	-.39895572-01	-.56290902 00
DY	.39825780-01	.57134220 00
DZ	.40517027-01	.56855149 00
KE	.45341665-01	.57024189 00
RE	.19693618-01	-.22907056 00
G	-.37934817-01	-.22784547 00
KM	-.49378563-02	-.40986622-01
RI(01)	.00000000 00	.00000000 00
LO(01)	.00000000 00	.00000000 00
RI(03)	.93838719-03	.49812971-02
LA(03)	.29002647-03	-.85256042-02
LO(03)	.42963379-01	.22202257 00
RI(04)	.31911825-02	.21286701-01
LA(04)	.22937321-02	.15287360-01
LO(04)	.45757545-02	.32071232-01
RI(05)	.10000000 01	.46253094-01
LO(05)	.46253094-01	.10000000 01

RA7 PRE M/C WITH POST DATA AS APRIORI 17 NOV

ITERATION NUMBER 3 EPOCH 64/07/28 171956.000 CLOCK 143720 SOS .10197 02 QSOS .10435 02

Q	DQ	STDEVDQ	OLD Q	NEW Q	NOMINAL Q	DQ (NOM)
X	.37887396-03	.68321287-01	-.48336127 04	-.48336123 04	-.48336202 04	.78735352-02
Y	-.95926800-03	.10873465 00	-.42062469 04	-.42062479 04	-.42062278 04	-.20080566-01
Z	-.16497839-02	.15011882 00	-.14413982 04	-.14413998 04	-.14413927 04	-.71258544-02
DX	.18244558-05	.76218855-04	.70601055 01	.70601073 01	.70601156 01	-.82254410-05
DY	.58344559-06	.32286250-03	-.68712140 01	-.68712135 01	-.68713167 01	.10317564-03
DZ	.31351139-05	.46305674-03	-.47797493 01	-.47797462 01	-.47795961 01	-.15002489-03
KE	-.53798468-03	.15318561 01	.39860146 06	.39860146 06	.39860128 06	.17968750 00
RE	.15257336-03	.36299631-01	.63783098 04	.63783100 04	.63783173 04	-.73242188-02
G	-.77723476-04	.29962612 00	.38302165 00	.38294392 00	.38917128 00	-.62273591-02
KM	.12872056-02	.16693766 00	.49026944 04	.49026957 04	.49026712 04	.24475097-01
STA 1						
RI	.11554015-02	.31962442 00	.63756511 04	.63756523 04	.63757069 04	-.54626464-01
LO	.14220297-04	.14778946-02	.27705561 02	.27705576 02	.27705399 02	.17666817-03
STA 3						
RI	.77833179-04	.58137191-01	.63719890 04	.63719891 04	.63719898 04	-.67138672-03
LA	.22804043-06	.73879037-03	.35118841 02	.35118841 02	.35118806 02	.34809113-04
LO	.19373587-05	.62449276-03	.24319465 03	.24319465 03	.24319449 03	.16403198-03
STA 4						
RI	.14137724-03	.57807282-01	.63725848 04	.63725850 04	.63725939 04	-.88500977-02
LA	.96984683-06	.77342942-03	-.31211879 02	-.31211878 02	-.31211947 02	.68664551-04
LO	.32252007-05	.64238346-03	.13688773 03	.13688773 03	.13688761 03	.12588501-03
STA 5						
RI	-.15898727-04	.25492887-01	.63754827 04	.63754826 04	.63754893 04	-.66528320-02
LO	.23796551-05	.61779560-03	.27685598 02	.27685600 02	.27685391 02	.20909309-03

COVARIANCE MATRIX OF ESTIMATED PARAMETERS ITERATION NUMBER 3

	X	Y	Z	DX	DY	DZ	KE	RE	G
X	.46677983-02	-.63089756-02	.30632731-03	.20867369-05	.10957668-04	-.13377846-04	.56456436-01	-.13415631-02	.51077855-03
Y	-.63089756-02	.11823224-01	.49885839-02	-.31043212-05	-.23570972-04	.24966729-04	-.11117983 00	.88521590-03	-.12048698-02
Z	.30632731-03	.49885839-02	.22535660-01	-.24350192-06	-.28655974-04	.23600843-04	.36649735-01	-.22596328-02	-.16942589-02
DX	.20867369-05	-.31043212-05	-.24350192-06	.58093139-08	-.65861075-08	.19014308-07	.21114945-06	.79235398-06	.24799734-05
DY	.10957668-04	-.23570972-04	-.28655974-04	-.65861075-08	.10424020-06	-.13903219-06	.16663406-03	-.41968200-05	.29590266-06
DZ	-.13377846-04	.24966729-04	.23600843-04	.19014308-07	-.13903219-06	.21442155-06	-.26889595-03	.93396261-05	.45702814-05
KE	.56456436-01	-.11117983 00	.36649735-01	.21114945-06	.16663406-03	-.26889595-03	.23465833 01	-.11756211-01	.65221256-02
RE	-.13415631-02	.88521590-03	-.22596328-02	.79235398-06	-.41968200-05	.93396261-05	-.11756211-01	.13176632-02	.97060890-04
G	.51077855-03	-.12048698-02	-.16942589-02	.24799734-05	.29590266-06	.45702814-05	.65221256-02	.97060890-04	.89775812-01
KM	.41851987-02	-.51825403-02	.11870358-02	.46625326-05	.10621712-04	-.88637199-05	.13448153-01	-.21379249-02	.44422620-02
RI(01	-.11450525-02	.82417164-02	.38668580-01	.79711918-05	-.78118619-04	.97390784-04	.56008875-01	.40580537-04	-.53195161-03
LO(01)	.61324203-04	-.12792243-03	-.16811770-03	.32258980-07	.36663976-06	-.35542113-06	.59361497-03	.39275721-06	.21207963-04
RI(03	-.34721164-03	.38531289-03	-.41982807-03	.40261963-06	-.15548962-05	.33183475-05	-.96134286-02	.24052494-03	.32125143-04
LA(03)	.23237719-05	-.38391946-05	.12564581-05	.20218015-08	.84421534-08	-.87654296-08	.15511219-04	-.15129666-05	-.28041700-07
LO(03)	.27391556-04	-.25684303-04	.36894302-04	-.73127272-08	.87149335-07	-.16880971-06	.31833395-03	-.20314296-04	.30281011-05
RI(04)	.88761101-03	-.12363223-02	-.72365639-03	.23088198-05	-.33307029-05	.93983746-05	-.20066952-01	.29635388-03	.96861058-04
LA(04	-.23030658-04	.44181606-04	.20075231-04	-.20247408-07	-.54393047-07	.20286715-07	-.78954978-04	.26220665-05	.18060700-05
LO(04)	.25574654-04	-.20543318-04	.32528309-04	-.57997016-08	.85459674-07	-.16118337-06	.15858899-03	-.20564735-04	.44901486-05
RI(05	-.35570747-03	.42651425-03	.96532851-03	.54339592-06	-.43325225-05	.64318345-05	.55667437-02	.36458491-03	.81797685-04
LO(05)	.26214145-04	-.24788966-04	.32421404-04	-.55470767-08	.89209792-07	-.16453923-06	.24824384-03	-.19920318-04	.45779927-05

	KM	RI(01)	LO(01)	RI(03)	LA(03)	LO(03)	RI(04)	LA(04)	LO(04)
X	.41851987-02	-.11450525-02	.61324203-04	-.34721164-03	.23237719-05	.27391556-04	.88761101-03	-.23030658-04	.25574654-04
Y	-.51825403-02	.82417164-02	-.12792243-03	.38531289-03	-.38391946-05	-.25684303-04	-.12363223-02	.44181606-04	-.20543318-04
Z	.11870358-02	.38668580-01	-.16811770-03	-.41982807-03	.12564581-05	.36894302-04	-.72365639-03	.20075231-04	.32528309-04
DX	.46625326-05	.79711918-05	.32258980-07	.40261963-06	.20218015-08	-.73127272-08	.23088198-05	-.20247408-07	-.57997016-08
DY	.10621712-04	-.78118619-04	.36663976-06	-.15548962-05	.84421534-08	.87149335-07	-.33307029-05	-.54393047-07	.85459674-07
DZ	-.88637199-05	.97390784-04	-.35542113-06	.33183475-05	-.87654296-08	-.16880971-06	.93983746-05	.20286715-07	-.16118337-06
KE	.13448153-01	.56008875-01	.59361497-03	-.96134286-02	.15511219-04	.31833395-03	-.20066952-01	-.78954978-04	.15858899-03
RE	-.21379249-02	.40580537-04	.39275721-06	.24052494-03	-.15129666-05	-.20314296-04	.29635388-03	.26220665-05	-.20564735-04
G	.44422620-02	-.53195161-03	.21207963-04	.32125143-04	-.28041700-07	.30281011-05	.96861058-04	.18060700-05	.44901486-05
KM	.27868181-01	-.29954928-03	.47840111-04	.72925800-04	.46100390-05	.49514367-04	-.37939258-03	-.29477555-05	.55282620-04
RI(01	-.29954928-03	.10215977 00	-.32849937-03	.33020425-03	.87855413-06	.15896580-05	.29121702-02	.46823161-05	-.91115239-05
LO(01)	.47840111-04	-.32849937-03	.21841726-05	-.14115985-05	.23197022-07	.76188639-07	.17466902-04	-.47560248-06	.77427723-07
RI(03)	.72925800-04	.33020425-03	-.14115985-05	.33799330-02	.41481401-04	-.38096767-05	.11756580-03	.49209819-06	-.36916917-05
LA(03)	.46100390-05	.87855413-06	.23197022-07	.41481401-04	.54581121-06	.33394948-07	-.62986669-06	-.73467368-08	.30306559-07
LO(03)	.49514367-04	.15896580-05	.76188639-07	-.38096767-05	.33394948-07	.38999122-06	-.58725345-05	-.47319934-07	.37188360-06
RI(04	-.37939258-03	.29121702-02	.17466902-04	.11756580-03	-.62986669-06	-.58725345-05	.33416819-02	-.34445197-04	-.78030309-05
LA(04	-.29477555-05	.46823161-05	-.47560248-06	.49209819-06	-.73467368-08	-.47319934-07	-.34445197-04	.59819307-06	-.46649328-07
LO(04)	.55282620-04	-.91115239-05	.77427723-07	-.36916917-05	.30306559-07	.37188360-06	-.78030309-05	-.46649328-07	.41265651-06
RI(05	-.54633714-03	.38130845-02	-.11245593-04	.63230936-04	-.47186493-06	-.57478552-05	.11324937-03	.18911019-05	-.67423294-05
LO(05)	.53243634-04	-.48447363-05	.93368597-07	-.42476017-05	.28521603-07	.36938152-06	-.50297353-05	-.51642048-07	.37078005-06

	RI(05)	LO(05)
X	-.35570747-03	.26214145-04
Y	.42651425-03	-.24788966-04
Z	.96532851-03	.32421404-04
DX	.54339592-06	-.55470767-08
DY	-.43325225-05	.89209792-07
DZ	.64318345-05	-.16453923-06
KE	.55667437-02	.24824384-03
RE	.36458491-03	-.19920318-04
G	.81797685-04	.45779927-05
KM	-.54633714-03	.53243634-04
RI(01)	.38130845-02	-.48447363-05
LO(01	-.11245593-04	.93368597-07
RI(03)	.63230936-04	-.42476017-05
LA(03	-.47186493-06	.28521603-07
LO(03	-.57478552-05	.36938152-06
RI(04)	.11324937-03	-.50297353-05
LA(04)	.18911019-05	-.51642048-07
LO(04	-.67423294-05	.37078005-06
RI(05)	.64988731-03	-.62438415-05
LO(05	-.62438415-05	.38167141-06

CORRELATION MATRIX OF ESTIMATED PARAMETERS ITERATION NUMBER 3

	X	Y	Z	DX	DY	DZ	KE	RE	G
X	.99999999 00	-.84924863 00	.29867201-01	.40072758 00	.49675753 00	-.42285933 00	.53943538 00	-.54094467 00	.24951516-01
Y	-.84924863 00	.10000000 01	.30561466 00	-.37457283 00	-.67141638 00	.49586047 00	-.66748279 00	.22427406 00	-.36982179-01
Z	.29867201-01	.30561466 00	.10000000 01	-.21281626-01	-.59123811 00	.33951437 00	.15067694 00	-.41466799 00	-.37667340-01
DX	.40072758 00	-.37457283 00	-.21281626-01	.99999999 00	-.26763861 00	.53874578 00	.18084627-02	.28638786 00	.10859377 00
DY	.49675753 00	-.67141638 00	-.59123811 00	-.26763861 00	.10000000 01	-.92995845 00	.33692108 00	-.35809686 00	.30588035-02
DZ	-.42285933 00	.49586047 00	.33951437 00	.53874578 00	-.92995845 00	.10000000 01	-.37908104 00	.55563944 00	.32940415-01
KE	.53943538 00	-.66748279 00	.15067694 00	.18084627-02	.33692108 00	-.37908104 00	.10000000 01	-.21142055 00	.14209916-01
RE	-.54094467 00	.22427406 00	-.41466799 00	.28638786 00	-.35809686 00	.55563944 00	-.21142055 00	.10000000 01	.89240579-02
G	.24951516-01	-.36982179-01	-.37667340-01	.10859377 00	.30588035-02	.32940415-01	.14209916-01	.89240579-02	.10000000 01
KM	.36694901 00	-.28550940 00	.47366836-01	.36644192 00	.19707094 00	-.11466411 00	.52588446-01	-.35280596 00	.88811699-01
RI(01	-.52435981-01	.23714270 00	.80590364 00	.32720571 00	-.75700194 00	.65802698 00	.11439286 00	.34976441-02	-.55545963-02
LO(01)	.60734072 00	-.79604074 00	-.75776549 00	.28638135 00	.76838428 00	-.51935648 00	.26220646 00	.73211361-02	.47893415-01
RI(03	-.87414642-01	.60952501-01	-.48104120-01	.90861201-01	-.82838026-01	.12326325 00	-.10794593 00	.11397349 00	.18442142-02
LA(03)	.46037975-01	-.47791531-01	.11329002-01	.35904994-01	.35392757-01	-.25622279-01	.13705873-01	-.56416469-01	-.12667865-03
LO(03)	.64199737 00	-.37824434 00	.39354713 00	-.15363478 00	.43223412 00	-.58376197 00	.33276494 00	-.89613233 00	.16183159-01
RI(04)	.22474192 00	-.19668950 00	-.83390139-01	.52401660 00	-.17845787 00	.35110416 00	-.22661093 00	.14122964 00	.55922551-02
LA(04	-.43584253 00	.52535499 00	.17290387 00	-.34346803 00	-.21782368 00	.56644378-01	-.66640897-01	.93394391-01	.77935299-02
LO(04)	.58271927 00	-.29410898 00	.33731216 00	-.11845376 00	.41204938 00	-.54186570 00	.16116127 00	-.88191463 00	.23328493-01
RI(05	-.20422924 00	.15386738 00	.25224407 00	.27966294 00	-.52638583 00	.54485585 00	.14254901 00	.39398297 00	.10708837-01
LO(05)	.62106183 00	-.36901637 00	.34958425 00	-.11780315 00	.44724974 00	-.57516232 00	.26231050 00	-.88827868 00	.24731508-01

	KM	RI(01)	LO(01)	RI(03)	LA(03)	LO(03)	RI(04)	LA(04)	LO(04)
X	.36694901 00	-.52435981-01	.60734072 00	-.87414642-01	.46037975-01	.64199737 00	.22474192 00	-.43584253 00	.58271927 00
Y	-.28550940 00	.23714270 00	-.79604074 00	.60952501-01	-.47791531-01	-.37824434 00	-.19668950 00	.52535499 00	-.29410898 00
Z	.47366836-01	.80590364 00	-.75776549 00	-.48104120-01	.11329002-01	.39354713 00	-.83390139-01	.17290387 00	.33731216 00
DX	.36644192 00	.32720571 00	.28638135 00	.90861201-01	.35904994-01	-.15363478 00	.52401660 00	-.34346803 00	-.11845376 00
DY	.19707094 00	-.75700194 00	.76838428 00	-.82838026-01	.35392757-01	.43223412 00	-.17845787 00	-.21782368 00	.41204938 00
DZ	-.11466411 00	.65802698 00	-.51935648 00	.12326325 00	-.25622279-01	-.58376197 00	.35110416 00	.56644378-01	-.54186570 00
KE	.52588446-01	.11439286 00	.26220646 00	-.10794593 00	.13705873-01	.33276494 00	-.22661093 00	-.66640897-01	.16116127 00
RE	-.35280596 00	.34976441-02	.73211361-02	.11397349 00	-.56416469-01	-.89613233 00	.14122964 00	.93394391-01	-.88191463 00
G	.88811699-01	-.55545963-02	.47893415-01	.18442142-02	-.12667865-03	.16183159-01	.55922551-02	.77935299-02	.23328493-01
KM	.10000000 01	-.56140207-02	.19390741 00	.75140285-02	.37379118-01	.47495177 00	-.39314428-01	-.22830554-01	.51551340 00
RI(01	-.56140207-02	.10000000 01	-.69542631 00	.17770050-01	.37205517-02	.79640932-02	.15761380 00	.18940876-01	-.44376874-01
LO(01)	.19390741 00	-.69542631 00	.10000000 01	-.16429096-01	.21245527-01	.82550428-01	.20445129 00	-.41608298 00	.81556513-01
RI(03)	.75140285-02	.17770050-01	-.16429096-01	.10000000 01	.96577984 00	-.10493169 00	.34981979-01	.10944024-01	-.98850078-01
LA(03)	.37379118-01	.37205517-02	.21245527-01	.96577984 00	.99999999 00	.72382256-01	-.14748398-01	-.12857382-01	.63858843-01
LO(03)	.47495177 00	.79640932-02	.82550428-01	-.10493169 00	.72382256-01	.10000000 01	-.16267305 00	-.97970657-01	.92701181 00
RI(04	-.39314428-01	.15761380 00	.20445129 00	.34981979-01	-.14748398-01	-.16267305 00	.99999999 00	-.77041623 00	-.21012920 00
LA(04	-.22830554-01	.18940876-01	-.41608298 00	.10944024-01	-.12857382-01	-.97970657-01	-.77041623 00	.99999999 00	-.93892378-01
LO(04)	.51551340 00	-.44376874-01	.81556513-01	-.98850078-01	.63858843-01	.92701181 00	-.21012920 00	-.93892378-01	.10000000 01
RI(05	-.12837705 00	.46796939 00	-.29848317 00	.42663505-01	-.25054021-01	-.36104337 00	.76848293-01	.95912500-01	-.41171490 00
LO(05)	.51626010 00	-.24534961-01	.10226159 00	-.11826192 00	.62489620-01	.95742097 00	-.14083732 00	-.10807816 00	.93428031 00

	RI(05)	LO(05)
X	-.20422924 00	.62106183 00
Y	.15386738 00	-.36901637 00
Z	.25224407 00	.34958425 00
DX	.27966294 00	-.11780315 00
DY	-.52638583 00	.44724974 00
DZ	.54485585 00	-.57516232 00
KE	.14254901 00	.26231050 00
RE	.39398297 00	-.88827868 00
G	.10708837-01	.24731508-01
KM	-.12837705 00	.51626010 00
RI(01)	.46796939 00	-.24534961-01
LO(01	-.29848317 00	.10226159 00
RI(03)	.42663505-01	-.11826192 00
LA(03	-.25054021-01	.62489620-01
LO(03	-.36104337 00	.95742097 00
RI(04)	.76848293-01	-.14083732 00
LA(04)	.95912500-01	-.10807816 00
LO(04	-.41171490 00	.93428031 00
RI(05)	.99999999 00	-.39644964 00
LO(05	-.39644964 00	.10000000 01

STATION NUMBER 59 64/07/28 ITERATION NUMBER 3 PASS NUMBER 07/281 PAGE 1

FREQUENCY 7253.4

TIME	TC	Q	CC3	
172238	5	59	.87039559 05 .127 01	.0400
172243	5	59	.90912920 05 .110 01	-.3213
172248	5	59	.94877206 05 .957 00	.1934
172253	5	59	.98890349 05 .834 00	-.7500*
172258	5	59	.10290761 06 .734 00	.1865
172303	5	59	.10688374 06 .652 00	-.1387

DATA STATISTICS STATION 1 ITERATION 3

PASS	DATA TYPE	BEGINNING TIME	END TIME	NUMBER OF POINTS	STD DEV	RMS	FIRST MOMENT	SECOND MOMENT
07/281	CC3	7/28-172238	7/28-172303	5	.198 00	.198 00	-.801-02	.392-01

STATION NUMBER 12 64/07/29 ITERATION NUMBER 3 PASS NUMBER 07/291

FREQUENCY 8300.0

TIME	TC	Q	CC3	
071132	60	12	.10983475 06 .113 00	.0146
071232	60	12	.10982933 06 .111 00	-.0020
071332	60	12	.10982397 06 .108 00	.0127
071432	60	12	.10981866 06 .106 00	.0098
071532	60	12	.10981339 06 .104 00	.0215
071632	60	12	.10980818 06 .103 00	-.0029
071732	60	12	.10980303 06 .101 00	.0059
071832	60	12	.10979792 06 .996-01	.0107
071932	60	12	.10979287 06 .984-01	-.0010
072032	60	12	.10978786 06 .972-01	.0010
072132	60	12	.10978291 06 .962-01	.0020
072232	60	12	.10977802 06 .952-01	.0166
072332	60	12	.10977317 06 .945-01	-.0029
072432	60	12	.10976837 06 .935-01	.0088
072532	60	12	.10976363 06 .930-01	.0020
072632	60	12	.10975894 06 .923-01	-.0068
072732	60	12	.10975430 06 .918-01	.0166
072832	60	12	.10974971 06 .913-01	.0039
072932	60	12	.10974517 06 .908-01	-.0098
073032	60	12	.10974069 06 .903-01	.0078
073132	60	12	.10973626 06 .898-01	.0088
073232	60	12	.10973188 06 .896-01	-.0107
073332	60	12	.10972755 06 .891-01	.0195
073432	60	12	.10972327 06 .889-01	-.0029
073532	60	12	.10971904 06 .886-01	-.0098
073632	60	12	.10971487 06 .884-01	.0156
073732	60	12	.10971074 06 .881-01	.0059
073832	60	12	.10970667 06 .879-01	-.0068
073932	60	12	.10970265 06 .876-01	-.0020
074032	60	12	.10969868 06 .874-01	.0000
074132	60	12	.10969476 06 .874-01	.0020
074232	60	12	.10969090 06 .872-01	.0020
074332	60	12	.10968708 06 .869-01	.0000
074432	60	12	.10968332 06 .869-01	-.0020
074532	60	12	.10967961 06 .867-01	-.0059
074632	60	12	.10967594 06 .867-01	.0049
074732	60	12	.10967233 06 .864-01	-.0010
074832	60	12	.10966877 06 .864-01	.0088
074932	60	12	.10966526 06 .864-01	.0010
075032	60	12	.10966181 06 .862-01	-.0088
075132	60	12	.10965840 06 .862-01	-.0020
075232	60	12	.10965504 06 .862-01	-.0127
075332	60	12	.10965174 06 .859-01	.0088
075432	60	12	.10964849 06 .859-01	-.0039
075532	60	12	.10964528 06 .859-01	.0000
075632	60	12	.10964213 06 .859-01	.0020
075732	60	12	.10963903 06 .857-01	.0039
075832	60	12	.10963598 06 .857-01	-.0117
075932	60	12	.10963298 06 .857-01	.0059
080032	60	12	.10963003 06 .857-01	-.0098
080132	60	12	.10962712 06 .857-01	.0068
080232	60	12	.10962428 06 .854-01	-.0098
080332	60	12	.10962148 06 .854-01	.0049
080432	60	12	.10961873 06 .854-01	.0039
080532	60	12	.10961603 06 .854-01	.0039
080632	60	12	.10961338 06 .854-01	-.0146
080732	60	12	.10961078 06 .854-01	.0010
080832	60	12	.10960823 06 .854-01	-.0010
080932	60	12	.10960573 06 .854-01	-.0020
081032	60	12	.10960329 06 .852-01	-.0029
081132	60	12	.10960089 06 .852-01	.0127

STATION NUMBER 12 64/07/29 ITERATION NUMBER 3 PASS NUMBER 07/292

FREQUENCY 8300.0

TIME	TC	Q	CC3	
081232	60	12	.10959854 06 .852-01	-.0049
081332	60	12	.10959624 06 .852-01	-.0234
081432	60	12	.10959399 06 .852-01	.0117
081532	60	12	.10959179 06 .852-01	-.0049
081632	60	12	.10958964 06 .852-01	-.0049
081732	60	12	.10958754 06 .852-01	.0137
081832	60	12	.10958548 06 .852-01	-.0186
081932	60	12	.10958348 06 .852-01	.0010
082032	60	12	.10958153 06 .852-01	.0049
082132	60	12	.10957962 06 .852-01	-.0078
082232	60	12	.10957777 06 .852-01	-.0020
082332	60	12	.10957596 06 .852-01	-.0127
082432	60	12	.10957420 06 .850-01	.0107
082532	60	12	.10957250 06 .850-01	-.0137
082632	60	12	.10957084 06 .850-01	-.0039
082732	60	12	.10956922 06 .850-01	-.0098
082832	60	12	.10956766 06 .850-01	.0029
082932	60	12	.10956615 06 .850-01	-.0166
083032	60	12	.10956468 06 .850-01	.0156
083132	60	12	.10956327 06 .850-01	-.0166
083232	60	12	.10956190 06 .850-01	.0020
083332	60	12	.10956058 06 .850-01	-.0107
083432	60	12	.10955930 06 .850-01	-.0039

STATION NUMBER 12 64/07/29 ITERATION NUMBER 3 PASS NUMBER 07/293

FREQUENCY 8300.0

TIME	TC	Q	CC3			
084132	60	12	.10955174	06	.116	00	-.0039
084232	60	12	.10955085	06	.116	00	-.0127
084332	60	12	.10955000	06	.116	00	-.0029
084432	60	12	.10954920	06	.116	00	.0264
084532	60	12	.10954846	06	.116	00	.0088
084632	60	12	.10954775	06	.116	00	-.0049
084732	60	12	.10954710	06	.116	00	-.0010
084832	60	12	.10954649	06	.116	00	.0078
084932	60	12	.10954593	06	.116	00	.0020
085032	60	12	.10954542	06	.116	00	.0000
085132	60	12	.10954495	06	.116	00	-.0156
085232	60	12	.10954453	06	.116	00	-.0098
085332	60	12	.10954415	06	.116	00	-.0020
085432	60	12	.10954382	06	.116	00	.0283
085532	60	12	.10954354	06	.116	00	-.0225
085632	60	12	.10954330	06	.116	00	-.0020
085732	60	12	.10954311	06	.116	00	-.0117
085832	60	12	.10954296	06	.116	00	.0166
085932	60	12	.10954287	06	.116	00	-.0176
090032	60	12	.10954281	06	.116	00	.0029
090132	60	12	.10954280	06	.116	00	-.0049
090232	60	12	.10954284	06	.116	00	.0068
090332	60	12	.10954292	06	.116	00	-.0088
090432	60	12	.10954305	06	.116	00	-.0029
090532	60	12	.10954323	06	.116	00	.0059
090632	60	12	.10954344	06	.116	00	-.0117
090732	60	12	.10954371	06	.116	00	.0088
090832	60	12	.10954401	06	.116	00	.0020
090932	60	12	.10954437	06	.116	00	-.0166
091232	60	12	.10954569	06	.117	00	-.0244
091332	60	12	.10954622	06	.117	00	.0127
091432	60	12	.10954679	06	.117	00	-.0107
091532	60	12	.10954741	06	.117	00	-.0117
091632	60	12	.10954807	06	.117	00	-.0234
091732	60	12	.10954878	06	.117	00	.0215
091832	60	12	.10954953	06	.117	00	.0059
091932	60	12	.10955032	06	.117	00	-.0195
092032	60	12	.10955115	06	.117	00	-.0059
092132	60	12	.10955203	06	.117	00	-.0010
092232	60	12	.10955296	06	.117	00	-.0234
092332	60	12	.10955392	06	.117	00	.0107
092432	60	12	.10955493	06	.117	00	.0029
092532	60	12	.10955598	06	.117	00	-.0146
092632	60	12	.10955707	06	.117	00	.0254
092732	60	12	.10955821	06	.117	00	-.0264
092832	60	12	.10955939	06	.117	00	-.0049
092932	60	12	.10956061	06	.117	00	.0254
093232	60	12	.10956452	06	.117	00	-.0215
093332	60	12	.10956591	06	.117	00	.0068
093432	60	12	.10956734	06	.117	00	.0107
093532	60	12	.10956881	06	.117	00	-.0264
093632	60	12	.10957032	06	.117	00	-.0049
093732	60	12	.10957187	06	.117	00	.0244
093832	60	12	.10957347	06	.117	00	-.0039
093932	60	12	.10957510	06	.117	00	-.0049
094032	60	12	.10957678	06	.117	00	.0029
094132	60	12	.10957850	06	.117	00	.0029
094232	60	12	.10958025	06	.117	00	-.0039
094332	60	12	.10958205	06	.117	00	.0146
094432	60	12	.10958389	06	.118	00	-.0234
094532	60	12	.10958577	06	.118	00	-.0176
094632	60	12	.10958768	06	.118	00	-.0195
094732	60	12	.10958964	06	.118	00	.0244
094832	60	12	.10959164	06	.118	00	.0098
094932	60	12	.10959367	06	.118	00	-.0264
095032	60	12	.10959575	06	.118	00	-.0020
095132	60	12	.10959786	06	.118	00	.0000
095232	60	12	.10960002	06	.118	00	.0127
095332	60	12	.10960221	06	.118	00	.0029
095432	60	12	.10960445	06	.118	00	-.0127
095532	60	12	.10960671	06	.118	00	.0000
095632	60	12	.10960902	06	.118	00	-.0078
095732	60	12	.10961137	06	.118	00	-.0215
095832	60	12	.10961376	06	.118	00	.0107

DATA STATISTICS STATION 3 ITERATION 3

PASS	DATA TYPE	BEGINNING TIME	END TIME	NUMBER OF POINTS	STD DEV	RMS	FIRST MOMENT	SECOND MOMENT
07/291	CC3	7/29-071132	7/29-081132	61	.822-02	.842-02	.181-02	.709-04
07/292	CC3	7/29-081232	7/29-083432	23	.105-01	.112-01	-.399-02	.126-03
07/293	CC3	7/29-084132	7/29-095832	74	.142-01	.144-01	-.230-02	.207-03

STATION NUMBER 41 64/07/28 ITERATION NUMBER 3 PASS NUMBER 07/281

FREQUENCY 8169.0

TIME	TC	Q	CC3	
175332	60	41	.12837663 06 .850-01	-.0107
175432	60	41	.12885581 06 .850-01	.0078
175532	60	41	.12926856 06 .850-01	-.0283
175632	60	41	.12962240 06 .850-01	.0039
175732	60	41	.12992403 06 .850-01	.0059
175832	60	41	.13017943 06 .850-01	.0166
180432	60	41	.13099978 06 .852-01	-.0117
180532	60	41	.13105073 06 .852-01	.0225
180632	60	41	.13108427 06 .852-01	-.0078
180732	60	41	.13110242 06 .852-01	.0117
180832	60	41	.13110692 06 .852-01	.0059
180932	60	41	.13109936 06 .852-01	-.0156
181032	60	41	.13108112 06 .852-01	.0098
181132	60	41	.13105343 06 .852-01	-.0029
181232	60	41	.13101740 06 .852-01	.0029
181332	60	41	.13097398 06 .852-01	.0000
181432	60	41	.13092406 06 .852-01	.0098
181532	60	41	.13086840 06 .852-01	.0020
181632	60	41	.13080769 06 .852-01	-.0049
181732	60	41	.13074254 06 .852-01	.0059
181832	60	41	.13067352 06 .852-01	.0156
181932	60	41	.13060109 06 .852-01	-.0078
182032	60	41	.13052571 06 .852-01	.0215
182132	60	41	.13044776 06 .854-01	.0020
182232	60	41	.13036760 06 .854-01	-.0039
182332	60	41	.13028554 06 .854-01	.0049
182432	60	41	.13020187 06 .854-01	-.0010
182532	60	41	.13011682 06 .854-01	.0098
182632	60	41	.13003064 06 .854-01	-.0098
182732	60	41	.12994353 06 .854-01	.0068
182832	60	41	.12985566 06 .854-01	.0098
182932	60	41	.12976720 06 .854-01	.0010
183032	60	41	.12967830 06 .854-01	.0020
183432	60	41	.12932072 06 .854-01	.0146
183532	60	41	.12923133 06 .854-01	-.0010
183632	60	41	.12914212 06 .857-01	.0107
183732	60	41	.12905315 06 .857-01	-.0166
183832	60	41	.12896447 06 .857-01	.0068
183932	60	41	.12887616 06 .857-01	.0078
184032	60	41	.12878824 06 .857-01	.0059
184132	60	41	.12870077 06 .857-01	-.0098
184232	60	41	.12861379 06 .857-01	.0049
184332	60	41	.12852733 06 .857-01	.0000
184432	60	41	.12844142 06 .857-01	-.0039
184532	60	41	.12835608 06 .857-01	.0010
184632	60	41	.12827134 06 .857-01	.0068
184732	60	41	.12818722 06 .857-01	-.0068
184832	60	41	.12810374 06 .857-01	-.0078
184932	60	41	.12802091 06 .859-01	.0078
185032	60	41	.12793874 06 .859-01	-.0078
185132	60	41	.12785725 06 .859-01	.0010
185232	60	41	.12777644 06 .859-01	.0059
185332	60	41	.12769633 06 .859-01	-.0127
185432	60	41	.12761691 06 .859-01	.0039
185532	60	41	.12753820 06 .859-01	.0010
185832	60	41	.12730630 06 .859-01	-.0010
185932	60	41	.12723042 06 .859-01	-.0059
190032	60	41	.12715525 06 .862-01	-.0020
190132	60	41	.12708079 06 .862-01	-.0088
190232	60	41	.12700704 06 .862-01	-.0039
190332	60	41	.12693399 06 .862-01	.0127
190432	60	41	.12686164 06 .862-01	-.0068
190532	60	41	.12678999 06 .862-01	-.0059
190632	60	41	.12671903 06 .862-01	-.0010
190932	60	41	.12651029 06 .862-01	-.0049
191232	60	41	.12630762 06 .864-01	-.0010
191332	60	41	.12624138 06 .864-01	-.0029
191432	60	41	.12617581 06 .864-01	-.0078
191532	60	41	.12611087 06 .864-01	.0078
191632	60	41	.12604658 06 .864-01	.0000
191732	60	41	.12598292 06 .864-01	-.0088
191832	60	41	.12591989 06 .864-01	-.0107
192132	60	41	.12573450 06 .864-01	-.0020
192232	60	41	.12567392 06 .867-01	.0000
192332	60	41	.12561392 06 .867-01	-.0088
192432	60	41	.12555452 06 .867-01	-.0049
192532	60	41	.12549570 06 .867-01	-.0010
192632	60	41	.12543745 06 .867-01	-.0049
192932	60	41	.12526610 06 .867-01	.0029
193032	60	41	.12521008 06 .867-01	-.0176
193132	60	41	.12515461 06 .867-01	.0039
193232	60	41	.12509968 06 .869-01	-.0117
193332	60	41	.12504527 06 .869-01	.0127
193432	60	41	.12499139 06 .869-01	-.0215
193532	60	41	.12493802 06 .869-01	-.0039
193632	60	41	.12488516 06 .869-01	.0029
193732	60	41	.12483281 06 .869-01	-.0098
193832	60	41	.12478095 06 .869-01	-.0049
193932	60	41	.12472959 06 .869-01	-.0078
194032	60	41	.12467871 06 .869-01	.0029
194132	60	41	.12462831 06 .872-01	.0020
194232	60	41	.12457839 06 .872-01	-.0234
194332	60	41	.12452893 06 .872-01	-.0010
194432	60	41	.12447994 06 .872-01	-.0068
194532	60	41	.12443140 06 .872-01	-.0020
194632	60	41	.12438331 06 .872-01	.0029
194732	60	41	.12433567 06 .872-01	-.0215
194832	60	41	.12428847 06 .872-01	.0137
194932	60	41	.12424170 06 .872-01	-.0176
195032	60	41	.12419536 06 .874-01	.0059
195132	60	41	.12414944 06 .874-01	-.0117
195232	60	41	.12410394 06 .874-01	.0039
195332	60	41	.12405886 06 .874-01	-.0107
195432	60	41	.12401418 06 .874-01	-.0166

STATION NUMBER 41 64/07/28 ITERATION NUMBER 3 PASS NUMBER 07/281

FREQUENCY 8169.0

TIME	TC	Q	CC3	
195532	60	41	.12396991 06 .874-01	.0078
195632	60	41	.12392603 06 .874-01	-.0146
195732	60	41	.12388255 06 .874-01	.0020
195832	60	41	.12383945 06 .874-01	-.0029
195932	60	41	.12379674 06 .876-01	.0117
200032	60	41	.12375440 06 .876-01	-.0049
200132	60	41	.12371244 06 .876-01	-.0107
200232	60	41	.12367085 06 .876-01	-.0020
200332	60	41	.12362962 06 .876-01	-.0088
200432	60	41	.12358876 06 .876-01	-.0078
200532	60	41	.12354825 06 .876-01	.0029
200632	60	41	.12350809 06 .876-01	-.0039
200732	60	41	.12346827 06 .876-01	-.0078
200832	60	41	.12342880 06 .879-01	.0117
200932	60	41	.12338967 06 .879-01	-.0068
201032	60	41	.12335088 06 .879-01	-.0107
201132	60	41	.12331241 06 .879-01	.0068
201232	60	41	.12327427 06 .879-01	-.0020
201332	60	41	.12323645 06 .879-01	-.0010
201432	60	41	.12319895 06 .879-01	-.0020
201532	60	41	.12316176 06 .879-01	-.0156
201632	60	41	.12312489 06 .881-01	-.0078
201732	60	41	.12308832 06 .881-01	.0078
201832	60	41	.12305206 06 .881-01	-.0107
201932	60	41	.12301610 06 .881-01	.0039
202032	60	41	.12298043 06 .881-01	.0059
202132	60	41	.12294505 06 .881-01	-.0010
202232	60	41	.12290996 06 .881-01	.0020
202332	60	41	.12287516 06 .881-01	-.0127
202432	60	41	.12284064 06 .881-01	.0068
202532	60	41	.12280640 06 .884-01	-.0020
202632	60	41	.12277244 06 .884-01	-.0205
202732	60	41	.12273874 06 .884-01	.0078
202832	60	41	.12270532 06 .884-01	-.0020
202932	60	41	.12267216 06 .884-01	.0068
203032	60	41	.12263926 06 .884-01	-.0127
203132	60	41	.12260662 06 .884-01	-.0098
203232	60	41	.12257424 06 .884-01	.0049
203332	60	41	.12254212 06 .886-01	-.0010
203432	60	41	.12251024 06 .886-01	-.0244
203532	60	41	.12247861 06 .886-01	.0225
203632	60	41	.12244723 06 .886-01	-.0098
203732	60	41	.12241608 06 .886-01	.0010
203832	60	41	.12238518 06 .886-01	-.0117
203932	60	41	.12235451 06 .886-01	.0078
204032	60	41	.12232407 06 .886-01	-.0068
204132	60	41	.12229387 06 .889-01	-.0020
204232	60	41	.12226389 06 .889-01	-.0078
204332	60	41	.12223414 06 .889-01	-.0059
204432	60	41	.12220461 06 .889-01	-.0088
204532	60	41	.12217530 06 .889-01	.0166
204632	60	41	.12214621 06 .889-01	-.0078
204732	60	41	.12211733 06 .889-01	.0195
204832	60	41	.12208866 06 .891-01	.0010
204932	60	41	.12206021 06 .891-01	-.0117
205032	60	41	.12203196 06 .891-01	.0020
205132	60	41	.12200392 06 .891-01	.0117
205232	60	41	.12197608 06 .891-01	-.0156
205332	60	41	.12194844 06 .891-01	.0059
205432	60	41	.12192100 06 .891-01	-.0020
205532	60	41	.12189376 06 .891-01	.0088
205632	60	41	.12186671 06 .894-01	-.0078
205732	60	41	.12183985 06 .894-01	.0029
205832	60	41	.12181318 06 .894-01	.0059
205932	60	41	.12178669 06 .894-01	.0059
210032	60	41	.12176039 06 .894-01	-.0117

FREQUENCY 8510.2

211132	60	41	.12148298 06 .898-01	.0176
211232	60	41	.12145874 06 .898-01	-.0137
211332	60	41	.12143467 06 .898-01	.0137
211432	60	41	.12141075 06 .898-01	.0166
211532	60	41	.12138699 06 .898-01	-.0039
211632	60	41	.12136338 06 .898-01	.0059
211732	60	41	.12133992 06 .898-01	.0127
211832	60	41	.12131661 06 .901-01	-.0146
211932	60	41	.12129346 06 .901-01	.0088
212332	60	41	.12120228 06 .901-01	.0000
212432	60	41	.12117984 06 .901-01	.0039
212532	60	41	.12115755 06 .903-01	.0186
212632	60	41	.12113539 06 .903-01	-.0049
212732	60	41	.12111336 06 .903-01	.0029
212832	60	41	.12109147 06 .903-01	.0088
212932	60	41	.12106971 06 .903-01	-.0166
213032	60	41	.12104809 06 .903-01	.0088
213132	60	41	.12102660 06 .903-01	.0029
213232	60	41	.12100523 06 .906-01	.0039
213332	60	41	.12098399 06 .906-01	-.0068
213432	60	41	.12096287 06 .906-01	.0078
213532	60	41	.12094188 06 .906-01	.0146
213632	60	41	.12092102 06 .906-01	-.0176
213732	60	41	.12090027 06 .906-01	.0107
213832	60	41	.12087965 06 .906-01	.0029

FREQUENCY 8470.0

214132	60	41	.12081845 06 .908-01	.0000
214232	60	41	.12079829 06 .908-01	.0088
214332	60	41	.12077824 06 .908-01	.0039
214432	60	41	.12075831 06 .908-01	-.0137
214532	60	41	.12073849 06 .908-01	.0088
214632	60	41	.12071878 06 .911-01	.0039
214732	60	41	.12069917 06 .911-01	.0078

STATION NUMBER 41 64/07/28 ITERATION NUMBER 3 PASS NUMBER 07/281

FREQUENCY 8470.0

TIME	TC	Q	CC3	
214832	60	41	.12067968 06	.911-01 .0039
214932	60	41	.12066029 06	.911-01 .0117
215032	60	41	.12064100 06	.911-01 -.0195

FREQUENCY 8448.0

230832	60	41	.11937767 06	.940-01 .0078
230932	60	41	.11936370 06	.942-01 .0127
231032	60	41	.11934977 06	.942-01 -.0029
231132	60	41	.11933587 06	.942-01 .0098
231232	60	41	.11932201 06	.942-01 .0186
231332	60	41	.11930819 06	.942-01 -.0098
231432	60	41	.11929440 06	.945-01 .0107
231532	60	41	.11928065 06	.945-01 -.0059
231632	60	41	.11926694 06	.945-01 .0273
231732	60	41	.11925326 06	.945-01 .0088
231832	60	41	.11923961 06	.945-01 -.0107
231932	60	41	.11922599 06	.945-01 .0215
232032	60	41	.11921241 06	.947-01 -.0146
232132	60	41	.11919886 06	.947-01 .0010
232232	60	41	.11918535 06	.947-01 .0186
232332	60	41	.11917186 06	.947-01 .0049
232432	60	41	.11915841 06	.947-01 -.0068
232532	60	41	.11914498 06	.950-01 -.0156
232632	60	41	.11913159 06	.950-01 .0293
233032	60	41	.11907829 06	.952-01 -.0107
233132	60	41	.11906504 06	.952-01 .0088
233232	60	41	.11905181 06	.952-01 .0186
233332	60	41	.11903861 06	.952-01 .0020
233432	60	41	.11902544 06	.952-01 -.0078
233532	60	41	.11901229 06	.955-01 .0078
233632	60	41	.11899917 06	.955-01 -.0039
233732	60	41	.11898607 06	.955-01 -.0049
233832	60	41	.11897300 06	.955-01 -.0146
234132	60	41	.11893391 06	.957-01 -.0156
234232	60	41	.11892093 06	.957-01 -.0010
234332	60	41	.11890797 06	.957-01 -.0078
234432	60	41	.11889504 06	.959-01 .0137
234532	60	41	.11888212 06	.959-01 -.0029
234632	60	41	.11886922 06	.959-01 -.0078
234732	60	41	.11885635 06	.959-01 .0020
234832	60	41	.11884349 06	.962-01 .0078
234932	60	41	.11883066 06	.962-01 -.0068
235032	60	41	.11881784 06	.962-01 -.0068
235132	60	41	.11880504 06	.962-01 .0068
235232	60	41	.11879226 06	.964-01 .0049
235332	60	41	.11877950 06	.964-01 -.0195
235432	60	41	.11876676 06	.964-01 .0088
235532	60	41	.11875403 06	.967-01 -.0146
235632	60	41	.11874132 06	.967-01 .0117
235732	60	41	.11872863 06	.967-01 -.0117
235832	60	41	.11871595 06	.969-01 .0156
235932	60	41	.11870329 06	.969-01 -.0059

STATION NUMBER 41 64/07/29 ITERATION NUMBER 3 PASS NUMBER 07/291

FREQUENCY 8448.0

TIME	TC	Q	CC3	
000032	60	41	.11869064 06	.969-01 -.0107
000132	60	41	.11867801 06	.972-01 .0039
000232	60	41	.11866539 06	.972-01 .0039
000332	60	41	.11865279 06	.972-01 .0059
000432	60	41	.11864020 06	.974-01 -.0059
000532	60	41	.11862763 06	.974-01 .0020

DATA STATISTICS STATION 4 ITERATION 3

PASS	DATA TYPE	BEGINNING TIME	END TIME	NUMBER OF POINTS	STD DEV	RMS	FIRST MOMENT	SECOND MOMENT
07/281	CC3	7/28-175332	7/28-235932	252	.102-01	.103-01	-.271-03	.105-03
07/291	CC3	7/29-000032	7/29-000532	6	.603-02	.603-02	-.163-03	.364-04

STATION NUMBER 51 64/07/28 ITERATION NUMBER 3 PASS NUMBER 07/282

FREQUENCY 8424.0

TIME	TC	Q	CC3	
215332	60	51	.11694786 06 .918-01	.0059
215632	60	51	.11687403 06 .918-01	.0059
215732	60	51	.11684976 06 .918-01	.0020
215832	60	51	.11682567 06 .920-01	.0098
220232	60	51	.11673100 06 .920-01	-.0049
220332	60	51	.11670776 06 .920-01	.0098
220432	60	51	.11668467 06 .920-01	.0088
220732	60	51	.11661641 06 .920-01	.0068
220832	60	51	.11659398 06 .920-01	.0029
220932	60	51	.11657171 06 .923-01	.0068
221032	60	51	.11654960 06 .923-01	.0000
221132	60	51	.11652765 06 .923-01	.0020
221232	60	51	.11650585 06 .923-01	.0137
221332	60	51	.11648421 06 .923-01	.0166
221432	60	51	.11646273 06 .923-01	-.0029
221532	60	51	.11644141 06 .923-01	-.0088
221632	60	51	.11642023 06 .923-01	.0146
221732	60	51	.11639922 06 .923-01	-.0010
221832	60	51	.11637835 06 .923-01	.0000
221932	60	51	.11635763 06 .925-01	.0166
222032	60	51	.11633707 06 .925-01	-.0010
222132	60	51	.11631665 06 .925-01	.0146
222232	60	51	.11629638 06 .925-01	-.0010
222332	60	51	.11627626 06 .925-01	.0020
222432	60	51	.11625629 06 .925-01	.0068
222532	60	51	.11623646 06 .925-01	.0000
222632	60	51	.11621678 06 .925-01	.0146
222732	60	51	.11619725 06 .925-01	.0176
222832	60	51	.11617786 06 .928-01	.0098
222932	60	51	.11615861 06 .928-01	-.0078
223032	60	51	.11613950 06 .928-01	.0166
223432	60	51	.11606448 06 .928-01	.0244
223532	60	51	.11604607 06 .928-01	.0000
223632	60	51	.11602779 06 .930-01	-.0117
223732	60	51	.11600966 06 .930-01	.0225
223832	60	51	.11599166 06 .930-01	.0039
223932	60	51	.11597380 06 .930-01	.0010
224032	60	51	.11595607 06 .930-01	.0127
224132	60	51	.11593847 06 .930-01	.0068
224232	60	51	.11592101 06 .930-01	.0205
224332	60	51	.11590368 06 .930-01	.0000
224432	60	51	.11588649 06 .930-01	-.0039
224532	60	51	.11586942 06 .933-01	.0146
224632	60	51	.11585248 06 .933-01	.0010
224732	60	51	.11583567 06 .933-01	.0088
224832	60	51	.11581900 06 .933-01	.0039
224932	60	51	.11580244 06 .933-01	.0039
225032	60	51	.11578602 06 .933-01	.0098
225132	60	51	.11576973 06 .933-01	.0059
225232	60	51	.11575356 06 .933-01	.0088
225332	60	51	.11573751 06 .935-01	.0039
225432	60	51	.11572159 06 .935-01	-.0107
225532	60	51	.11570580 06 .935-01	.0186
225632	60	51	.11569013 06 .935-01	.0059
225732	60	51	.11567458 06 .935-01	.0059
230032	60	51	.11562866 06 .936-01	.0039
230132	60	51	.11561360 06 .938-01	.0010
230232	60	51	.11559865 06 .938-01	.0117
230332	60	51	.11558383 06 .938-01	.0039
230432	60	51	.11556912 06 .938-01	.0088

FREQUENCY 8391.6 64/07/29

001132	60	51	.11482482 06 .959-01	-.0068
001232	60	51	.11481692 06 .959-01	-.0020
001332	60	51	.11480909 06 .959-01	.0049
001632	60	51	.11478612 06 .959-01	-.0068
001732	60	51	.11477863 06 .959-01	.0020
001832	60	51	.11477122 06 .962-01	.0137
001932	60	51	.11476389 06 .962-01	-.0049
002032	60	51	.11475664 06 .962-01	-.0039
002132	60	51	.11474947 06 .962-01	-.0010
002232	60	51	.11474238 06 .962-01	.0068
002332	60	51	.11473536 06 .962-01	.0020
002432	60	51	.11472843 06 .962-01	.0010
002532	60	51	.11472158 06 .964-01	.0059
002632	60	51	.11471480 06 .964-01	-.0176
002732	60	51	.11470810 06 .964-01	.0146
002832	60	51	.11470148 06 .964-01	.0020
002932	60	51	.11469493 06 .964-01	-.0020
003032	60	51	.11468846 06 .964-01	.0000
003132	60	51	.11468207 06 .964-01	-.0059
003232	60	51	.11467575 06 .967-01	-.0039
003332	60	51	.11466951 06 .967-01	.0049
003432	60	51	.11466334 06 .967-01	.0059
003532	60	51	.11465725 06 .967-01	-.0176
003632	60	51	.11465123 06 .967-01	.0029
003732	60	51	.11464528 06 .967-01	-.0166
003832	60	51	.11463941 06 .967-01	.0225
003932	60	51	.11463361 06 .967-01	-.0088
004032	60	51	.11462788 06 .969-01	.0029
004132	60	51	.11462222 06 .969-01	.0098
004232	60	51	.11461664 06 .969-01	-.0205
004332	60	51	.11461112 06 .969-01	-.0059
004432	60	51	.11460568 06 .969-01	.0049
004532	60	51	.11460030 06 .969-01	.0127
004632	60	51	.11459500 06 .969-01	-.0176
004732	60	51	.11458976 06 .972-01	.0020
004832	60	51	.11458460 06 .972-01	.0020
004932	60	51	.11457950 06 .972-01	-.0010
005032	60	51	.11457447 06 .972-01	.0107
005132	60	51	.11456951 06 .972-01	-.0107
005232	60	51	.11456462 06 .972-01	-.0010
005332	60	51	.11455979 06 .972-01	.0098

STATION NUMBER 51 64/07/29 ITERATION NUMBER 3 PASS NUMBER 07/282

FREQUENCY 8391.6

TIME	TC	Q	CC3	
005432	60	51	.11455503 06 .974-01	.0029
005532	60	51	.11455034 06 .974-01	-.0029
005632	60	51	.11454571 06 .974-01	-.0088
005732	60	51	.11454114 06 .974-01	.0205
005832	60	51	.11453665 06 .974-01	-.0156
005932	60	51	.11453221 06 .974-01	.0010
010032	60	51	.11452785 06 .974-01	-.0137
010132	60	51	.11452354 06 .977-01	.0254
010232	60	51	.11451930 06 .977-01	-.0010
010332	60	51	.11451512 06 .977-01	-.0068
010432	60	51	.11451101 06 .977-01	.0088
010532	60	51	.11450695 06 .977-01	-.0059
010632	60	51	.11450296 06 .977-01	.0186
010732	60	51	.11449903 06 .977-01	-.0020
010832	60	51	.11449517 06 .977-01	-.0176
010932	60	51	.11449136 06 .979-01	.0059
011032	60	51	.11448761 06 .979-01	.0020
011132	60	51	.11448393 06 .979-01	-.0117
011232	60	51	.11448030 06 .979-01	.0156
011332	60	51	.11447673 06 .979-01	-.0010
011432	60	51	.11447323 06 .979-01	.0068
011532	60	51	.11446977 06 .979-01	-.0088
011632	60	51	.11446638 06 .981-01	-.0010
011732	60	51	.11446305 06 .981-01	-.0010
011832	60	51	.11445978 06 .981-01	.0078
011932	60	51	.11445656 06 .981-01	-.0068
012032	60	51	.11445339 06 .981-01	.0049
012132	60	51	.11445029 06 .981-01	.0107
012232	60	51	.11444724 06 .981-01	-.0068
012332	60	51	.11444424 06 .984-01	-.0127
012432	60	51	.11444131 06 .984-01	.0098
012532	60	51	.11443842 06 .984-01	.0107
012632	60	51	.11443559 06 .984-01	-.0107
012732	60	51	.11443282 06 .984-01	-.0020
012832	60	51	.11443010 06 .984-01	.0029
012932	60	51	.11442743 06 .984-01	.0039
013032	60	51	.11442481 06 .986-01	.0020
013132	60	51	.11442225 06 .986-01	-.0029
013232	60	51	.11441974 06 .986-01	.0068
013332	60	51	.11441728 06 .986-01	-.0020
013432	60	51	.11441488 06 .986-01	-.0137
013532	60	51	.11441253 06 .986-01	.0078
013632	60	51	.11441022 06 .986-01	-.0059
013732	60	51	.11440797 06 .989-01	-.0029
013832	60	51	.11440576 06 .989-01	.0010
013932	60	51	.11440361 06 .989-01	-.0127
014032	60	51	.11440151 06 .989-01	.0078
014132	60	51	.11439945 06 .989-01	.0107
014232	60	51	.11439745 06 .989-01	-.0156
014332	60	51	.11439549 06 .989-01	.0078
014432	60	51	.11439358 06 .991-01	-.0166
014532	60	51	.11439172 06 .991-01	-.0049
014632	60	51	.11438991 06 .991-01	.0088
014732	60	51	.11438814 06 .991-01	.0088
014832	60	51	.11438642 06 .991-01	-.0205
014932	60	51	.11438475 06 .991-01	.0215
015032	60	51	.11438312 06 .991-01	-.0176
015132	60	51	.11438153 06 .994-01	-.0176
015632	60	51	.11437429 06 .994-01	-.0098
015732	60	51	.11437298 06 .994-01	.0234
015832	60	51	.11437170 06 .996-01	-.0205
015932	60	51	.11437047 06 .996-01	.0098
020032	60	51	.11436928 06 .996-01	-.0010
020132	60	51	.11436814 06 .996-01	-.0059
020232	60	51	.11436704 06 .996-01	.0146
020332	60	51	.11436597 06 .996-01	-.0215
020432	60	51	.11436495 06 .999-01	.0156
020532	60	51	.11436397 06 .999-01	.0127
020632	60	51	.11436303 06 .999-01	-.0127
020732	60	51	.11436213 06 .999-01	.0049
020832	60	51	.11436127 06 .999-01	-.0010
020932	60	51	.11436045 06 .999-01	.0029
021032	60	51	.11435966 06 .999-01	.0029
021132	60	51	.11435892 06 .100 00	.0127
021232	60	51	.11435821 06 .100 00	.0010
021332	60	51	.11435755 06 .100 00	-.0137
021432	60	51	.11435692 06 .100 00	-.0010
021532	60	51	.11435632 06 .100 00	.0254
021632	60	51	.11435577 06 .100 00	-.0020
021732	60	51	.11435525 06 .100 00	-.0176
021832	60	51	.11435477 06 .100 00	-.0010
021932	60	51	.11435432 06 .100 00	-.0039
022032	60	51	.11435391 06 .100 00	.0059
022132	60	51	.11435353 06 .100 00	-.0010
022232	60	51	.11435319 06 .100 00	.0059
022332	60	51	.11435289 06 .100 00	.0117
022432	60	51	.11435262 06 .100 00	-.0166
022532	60	51	.11435238 06 .101 00	-.0117
022632	60	51	.11435217 06 .101 00	.0078
022732	60	51	.11435200 06 .101 00	.0137
022832	60	51	.11435187 06 .101 00	.0166
022932	60	51	.11435176 06 .101 00	-.0107
023032	60	51	.11435169 06 .101 00	-.0049
023132	60	51	.11435165 06 .101 00	.0029
023232	60	51	.11435164 06 .101 00	-.0049
023332	60	51	.11435166 06 .101 00	.0059
023432	60	51	.11435171 06 .101 00	.0029
023532	60	51	.11435180 06 .101 00	.0029
023632	60	51	.11435191 06 .101 00	-.0117
023732	60	51	.11435205 06 .101 00	.0117
023832	60	51	.11435223 06 .101 00	-.0127
023932	60	51	.11435243 06 .101 00	.0176
024032	60	51	.11435266 06 .101 00	.0020
024132	60	51	.11435292 06 .101 00	-.0088

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FREQUENCY 8391.6

TIME	TC	Q	CC3	
024232	60	51	.11435321 06 .101 00	.0186
024332	60	51	.11435353 06 .101 00	.0020
024432	60	51	.11435388 06 .101 00	-.0107
024532	60	51	.11435425 06 .101 00	.0010
024632	60	51	.11435465 06 .101 00	.0000
024732	60	51	.11435507 06 .101 00	.0078
024832	60	51	.11435553 06 .101 00	.0049
024932	60	51	.11435601 06 .101 00	-.0068
025032	60	51	.11435651 06 .101 00	.0049
025132	60	51	.11435704 06 .102 00	.0078
025232	60	51	.11435760 06 .102 00	-.0146
025332	60	51	.11435818 06 .102 00	.0049
025432	60	51	.11435878 06 .102 00	.0000
025532	60	51	.11435941 06 .102 00	.0039
025632	60	51	.11436006 06 .102 00	.0010
025732	60	51	.11436074 06 .102 00	.0078
025832	60	51	.11436144 06 .102 00	-.0098
025932	60	51	.11436216 06 .102 00	.0010
030032	60	51	.11436291 06 .102 00	.0059
030132	60	51	.11436368 06 .102 00	.0039
030232	60	51	.11436447 06 .102 00	.0146
030332	60	51	.11436528 06 .102 00	.0029
030432	60	51	.11436611 06 .102 00	.0029
030532	60	51	.11436697 06 .102 00	.0146
030632	60	51	.11436784 06 .102 00	-.0098
030732	60	51	.11436874 06 .102 00	-.0049
030832	60	51	.11436965 06 .102 00	.0127
030932	60	51	.11437059 06 .102 00	-.0068
031032	60	51	.11437154 06 .102 00	.0059
031132	60	51	.11437252 06 .102 00	.0146
031232	60	51	.11437351 06 .102 00	.0049
031332	60	51	.11437452 06 .102 00	-.0078
031432	60	51	.11437555 06 .102 00	.0117
031532	60	51	.11437660 06 .102 00	-.0029
031632	60	51	.11437767 06 .102 00	-.0029
031732	60	51	.11437875 06 .103 00	.0146
031832	60	51	.11437985 06 .103 00	-.0029
031932	60	51	.11438097 06 .103 00	-.0049
032032	60	51	.11438210 06 .103 00	.0127
032132	60	51	.11438325 06 .103 00	-.0215
032232	60	51	.11438442 06 .103 00	.0117
032332	60	51	.11438560 06 .103 00	-.0029
032432	60	51	.11438680 06 .103 00	.0000
032532	60	51	.11438801 06 .103 00	.0059
032632	60	51	.11438924 06 .103 00	-.0059
032732	60	51	.11439048 06 .103 00	.0029
032832	60	51	.11439173 06 .103 00	-.0020
032932	60	51	.11439300 06 .103 00	-.0039
033032	60	51	.11439428 06 .103 00	-.0029
033132	60	51	.11439558 06 .103 00	.0176
033232	60	51	.11439689 06 .103 00	-.0078
033332	60	51	.11439821 06 .103 00	.0029
033432	60	51	.11439955 06 .103 00	.0029
033532	60	51	.11440089 06 .103 00	.0059
033632	60	51	.11440225 06 .103 00	.0156
033732	60	51	.11440362 06 .103 00	-.0039
033832	60	51	.11440500 06 .103 00	.0156
033932	60	51	.11440639 06 .103 00	.0078
034032	60	51	.11440779 06 .103 00	.0059
034132	60	51	.11440921 06 .103 00	-.0068
034232	60	51	.11441063 06 .104 00	.0039
034332	60	51	.11441206 06 .104 00	.0215
034432	60	51	.11441350 06 .104 00	-.0029
034532	60	51	.11441495 06 .104 00	.0127
034632	60	51	.11441641 06 .104 00	.0029
034732	60	51	.11441788 06 .104 00	.0010
034832	60	51	.11441936 06 .104 00	.0244
034932	60	51	.11442084 06 .104 00	-.0107
035032	60	51	.11442233 06 .104 00	-.0029
035132	60	51	.11442384 06 .104 00	.0137
035232	60	51	.11442534 06 .104 00	.0059
035332	60	51	.11442686 06 .104 00	.0078
035432	60	51	.11442838 06 .104 00	.0039
035532	60	51	.11442991 06 .104 00	.0098
035632	60	51	.11443144 06 .104 00	-.0078
035732	60	51	.11443298 06 .104 00	.0205
040132	60	51	.11443919 06 .104 00	-.0068
040232	60	51	.11444075 06 .104 00	-.0029
040332	60	51	.11444232 06 .104 00	.0117
040432	60	51	.11444389 06 .104 00	.0049
040532	60	51	.11444547 06 .104 00	.0127
040632	60	51	.11444705 06 .104 00	.0000
040732	60	51	.11444863 06 .104 00	.0010
040832	60	51	.11445022 06 .104 00	-.0020
040932	60	51	.11445180 06 .104 00	.0117
041032	60	51	.11445339 06 .104 00	-.0127
041132	60	51	.11445499 06 .104 00	.0127
041232	60	51	.11445658 06 .104 00	-.0146
041332	60	51	.11445818 06 .105 00	.0059
041432	60	51	.11445977 06 .105 00	.0098
041532	60	51	.11446137 06 .105 00	-.0049
041632	60	51	.11446297 06 .105 00	-.0029
041732	60	51	.11446457 06 .105 00	-.0020
041832	60	51	.11446617 06 .105 00	.0156
041932	60	51	.11446777 06 .105 00	.0010
042032	60	51	.11446936 06 .105 00	.0020
042132	60	51	.11447096 06 .105 00	.0039
042232	60	51	.11447256 06 .105 00	.0068
042332	60	51	.11447416 06 .105 00	-.0068
042432	60	51	.11447575 06 .105 00	-.0186
042732	60	51	.11448052 06 .105 00	.0098
043032	60	51	.11448527 06 .105 00	.0078
043732	60	51	.11449624 06 .106 00	-.0254
044532	60	51	.11450848 06 .106 00	.0068

STATION NUMBER 51 64/07/29 ITERATION NUMBER 3 PASS NUMBER 07/282

FREQUENCY 8391.6

TIME	TC	Q	CC3	
044632	60	51	.11450998 06 .106 00	.0059
044732	60	51	.11451147 06 .106 00	-.0049
044832	60	51	.11451296 06 .106 00	-.0078
044932	60	51	.11451444 06 .106 00	.0127
045032	60	51	.11451591 06 .106 00	.0078
045132	60	51	.11451737 06 .106 00	-.0059
045232	60	51	.11451883 06 .106 00	.0059
045532	60	51	.11452314 06 .106 00	.0088
045632	60	51	.11452456 06 .106 00	-.0107
045732	60	51	.11452597 06 .106 00	.0117
045832	60	51	.11452737 06 .106 00	-.0059
045932	60	51	.11452876 06 .106 00	.0029
050032	60	51	.11453014 06 .106 00	.0049
050132	60	51	.11453151 06 .107 00	.0020
050232	60	51	.11453287 06 .107 00	-.0088
050332	60	51	.11453422 06 .107 00	.0254
050432	60	51	.11453556 06 .107 00	-.0127
050532	60	51	.11453689 06 .107 00	.0098
050632	60	51	.11453820 06 .107 00	.0107
050732	60	51	.11453951 06 .107 00	.0068
050832	60	51	.11454080 06 .107 00	-.0020
050932	60	51	.11454208 06 .107 00	.0186
051232	60	51	.11454585 06 .107 00	.0029
051332	60	51	.11454708 06 .107 00	.0068
051432	60	51	.11454829 06 .107 00	.0078
052032	60	51	.11455530 06 .107 00	-.0010
052132	60	51	.11455642 06 .107 00	-.0029
052232	60	51	.11455752 06 .107 00	.0283
052332	60	51	.11455861 06 .107 00	-.0107
052432	60	51	.11455968 06 .108 00	-.0010
052532	60	51	.11456074 06 .108 00	.0098
053032	60	51	.11456579 06 .108 00	-.0029
053132	60	51	.11456674 06 .108 00	.0205
053432	60	51	.11456952 06 .108 00	-.0068
053532	60	51	.11457041 06 .108 00	.0020
053632	60	51	.11457129 06 .108 00	.0127
053732	60	51	.11457214 06 .108 00	-.0098
053832	60	51	.11457298 06 .108 00	.0029
054132	60	51	.11457538 06 .108 00	.0020
054232	60	51	.11457614 06 .108 00	.0059
054332	60	51	.11457689 06 .108 00	.0127
054432	60	51	.11457761 06 .108 00	-.0117
054532	60	51	.11457832 06 .108 00	.0166
054632	60	51	.11457900 06 .108 00	-.0020
054732	60	51	.11457967 06 .109 00	.0146
054832	60	51	.11458031 06 .109 00	.0039
054932	60	51	.11458094 06 .109 00	.0107
055032	60	51	.11458154 06 .109 00	-.0098
055132	60	51	.11458213 06 .109 00	.0049
055232	60	51	.11458269 06 .109 00	.0078
055332	60	51	.11458323 06 .109 00	-.0020
055432	60	51	.11458375 06 .109 00	-.0059
055532	60	51	.11458426 06 .109 00	.0273
055632	60	51	.11458474 06 .109 00	-.0029
055732	60	51	.11458519 06 .109 00	-.0098
055832	60	51	.11458563 06 .109 00	.0049
055932	60	51	.11458604 06 .109 00	.0244
060032	60	51	.11458643 06 .109 00	-.0166
060132	60	51	.11458680 06 .109 00	-.0020
060232	60	51	.11458715 06 .109 00	.0186
060332	60	51	.11458747 06 .109 00	.0107
060432	60	51	.11458777 06 .109 00	.0107
060532	60	51	.11458805 06 .109 00	.0156
060632	60	51	.11458830 06 .109 00	-.0049
060732	60	51	.11458853 06 .109 00	.0137
060832	60	51	.11458874 06 .109 00	.0059
060932	60	51	.11458893 06 .110 00	.0049
061032	60	51	.11458909 06 .110 00	-.0059
061132	60	51	.11458922 06 .110 00	.0078
061232	60	51	.11458934 06 .110 00	.0127
061332	60	51	.11458942 06 .110 00	-.0078
061432	60	51	.11458949 06 .110 00	.0293
061532	60	51	.11458952 06 .110 00	-.0088
061632	60	51	.11458954 06 .110 00	.0107
061732	60	51	.11458953 06 .110 00	.0049
061832	60	51	.11458949 06 .110 00	.0088
062232	60	51	.11458909 06 .110 00	.0088
062332	60	51	.11458893 06 .110 00	.0068
062432	60	51	.11458873 06 .110 00	-.0029
062532	60	51	.11458852 06 .110 00	-.0176
062632	60	51	.11458827 06 .110 00	.0088
062732	60	51	.11458800 06 .110 00	-.0039
062832	60	51	.11458771 06 .110 00	.0078
062932	60	51	.11458738 06 .110 00	.0156
063032	60	51	.11458703 06 .110 00	-.0176
063132	60	51	.11458666 06 .111 00	-.0068
063232	60	51	.11458625 06 .111 00	.0156
063332	60	51	.11458582 06 .111 00	-.0020
063432	60	51	.11458536 06 .111 00	.0068
063532	60	51	.11458487 06 .111 00	-.0049
063632	60	51	.11458436 06 .111 00	.0107
063732	60	51	.11458381 06 .111 00	-.0127
063832	60	51	.11458324 06 .111 00	.0088
063932	60	51	.11458264 06 .111 00	.0078
064032	60	51	.11458201 06 .111 00	.0205
064132	60	51	.11458136 06 .111 00	-.0068
064232	60	51	.11458067 06 .111 00	-.0049
064332	60	51	.11457996 06 .111 00	.0254
064432	60	51	.11457921 06 .111 00	-.0146
064532	60	51	.11457844 06 .111 00	-.0088
064632	60	51	.11457764 06 .111 00	.0264
064732	60	51	.11457681 06 .111 00	-.0098
064832	60	51	.11457595 06 .111 00	.0166
064932	60	51	.11457506 06 .111 00	-.0098

STATION NUMBER 51 64/07/29 ITERATION NUMBER 3 PASS NUMBER 07/282

FREQUENCY 8391.6

TIME	TC	Q		CC3	
065032	60	51	.11457414 06	.111 00	.0098
065132	60	51	.11457319 06	.111 00	.0088
065232	60	51	.11457221 06	.112 00	-.0117
065332	60	51	.11457120 06	.112 00	.0137
065432	60	51	.11457016 06	.112 00	.0039
065532	60	51	.11456909 06	.112 00	.0078
065632	60	51	.11456799 06	.112 00	.0088
065732	60	51	.11456686 06	.112 00	.0059
065832	60	51	.11456570 06	.112 00	.0166
065932	60	51	.11456451 06	.112 00	-.0059
070232	60	51	.11456074 06	.112 00	.0078
070332	60	51	.11455942 06	.112 00	-.0088
070432	60	51	.11455808 06	.112 00	.0068
070532	60	51	.11455670 06	.112 00	-.0137
070632	60	51	.11455528 06	.112 00	.0156

DATA STATISTICS STATION 5 ITERATION 3

PASS	DATA TYPE	BEGINNING TIME	END TIME	NUMBER OF POINTS	STD DEV	RMS	FIRST MOMENT	SECOND MOMENT
07/282	CC3	7/28-215332	7/29-070632	428	.102-01	.106-01	.255-02	.111-03

CASE 1 SPACE TRAJECTORIES

EPHEMERIS TAPE IV WITH MARS VELOCITIES. B-8 IS

GME	.39860146 06	J	.16234500-02	H	-.57499999-05	D	.78749999-05	RE	.63781650 04	REM	.63783100 04
G	.66709998-19	A	.88782497 29	B	.88800499 29	C	.88837498 29	OME	.41780741-02	AU	.14959900 09
GMM	.49026957 04	GMS	.13271544 12	GMV	.32476952 06	GMA	.42977799 05	GMC	.37918700 08	GMJ	.12671062 09
EGM	.39860320 06	MGM	.49027779 04	JA	.29200000-02	HA	.00000000 00	DA	.00000000 00	RA	.34170000 04
ARA	.35670000 01	GB	.38294392 00	MAS	.37410000 03	GB1	.00000000 00	GB2	.00000000 00	SC	.10200000 09

INJECTION CONDITIONS MOON 23566645025720200000000 J.D.= 2438605.22217592 JULY 28,1964 17 19 56.000

GEOCENTRIC X0-.48336123 04 Y0-.42062479 04 Z0-.14413998 04 DX0 .70601073 01 DY0-.68712135 01 DZ0-.47797462 01
CARTESIAN GMC .00000000 00 SGC .00000000 00 T0 .62396000 05 GHA .20638174 03 GMO .30568662 03
DATE OF RUN 111764A 000000 EARTH IS THE CENTRAL BODY FOR INTEGRATION COWELL EQUATIONS OF MOTION

0 DAYS 0 HRS. 0 MIN. 0.000 SEC. 23566645025720200000000 J.D.= 2438605.22217592 JULY 28,1964 17 19 56.000

GEOCENTRIC EQUATORIAL COORDINATES

X	-.48336122 04	Y	-.42062477 04	Z	-.14413998 04	DX	.70601070 01	DY	-.68712133 01	DZ	-.47797460 01
R	.65676448 04	DEC	-.12677893 02	RA	.22103005 03	V	.10950098 02	PTH	.13272056 01	AZ	.11625194 03
R	.65676448 04	LAT	-.12677893 02	LON	.14648313 02	VE	.10533192 02	PTE	.13797477 01	AZE	.11737653 03
XS	-.88492690 08	YS	.11325740 09	ZS	-.49113300 08	DXS	-.23722515 02	DYS	-.15814255 02	DZS	-.68579680 01
XM	.38246584 06	YM	-.30198953 05	ZM	-.50845670 05	DXM	.82773604-01	DYM	.93298925 00	DZM	.39361317 00
XT	.38246584 06	YT	-.30198953 05	ZT	-.50845670 05	DXT	.82773604-01	DYT	.93298925 00	DZT	.39361317 00
RS	.15188914 09	VS	.29323712 02	RM	.38701081 06	VM	.10159979 01	RT	.38701081 06	VT	.10159979 01
GED	-.12761470 02	ALT	.19047845 03	LOS	.28162025 03	RAS	.12800198 03	RAM	.35548537 03	LOM	.14910364 03
DUT	.35000000 02	DT	.37500000 01	DR	.25362675 00	SHA	.65203972 04	DES	.18865618 02	DEM	-.75493738 01
DAC	.00000000 00	CCL	.81704570 02	MCL	.18380598 03	TCL	.18380598 03				

GEOCENTRIC CONIC

EPOCH OF PERICENTER PASSAGE 23566645024720276042706O J.D.= 2438605.22185045 JULY 28,1964 17 19 27.879

SMA	.26955792 06	ECC	.97564873 00	B	.59124535 05	SLR	.12968311 05	APO	.53255177 06	RCA	.65640773 04
VH	.13500483 00	C3	-.14787228 01	C1	.71897063 05	TEP	.28120741 02	TF	-.78113170-02	PER	.23213323 05
TA	.26875478 01	MTA	.00000000 00	EA	.29842718 00	MA	.72684311-02	C3J	-.18712397 01	TFI	.00000000 00

ALL VECTORS REFERENCED TO EARTH EQUATOR PLANE

X	-.48336122 04	Y	-.42062477 04	Z	-.14413998 04	DX	.70601070 01	DY	-.68712133 01	DZ	-.47797460 01
INC	.28955996 02	LAN	.17040849 02	APF	.20426939 03	MX	.66197710 00	MY	-.61283270 00	MZ	-.43153496 00
WX	.14187827 00	WY	-.46288225 00	WZ	.87499177 00	PX	-.76620355 00	PY	-.61101016 00	PZ	-.19899402 00
QX	.62673964 00	QY	-.64218887 00	QZ	-.44135109 00	RX	.15558145 00	RY	.12406866 00	RZ	-.98000066 00
BX	-.62673967 00	BY	.64218890 00	BZ	.44135111 00	TX	-.62347934 00	TY	.78183983 00	TZ	.00000000 00
DAP	-.11478139 02	RAP	.21857066 03								
BTQ	.52789228 05	BRQ	-.26627203 05	B	.59124535 05	THA	.33323335 03				

HELIOCENTRIC EQUATORIAL COORDINATES

X	.88487856 08	Y	-.11326160 09	Z	-.49114741 08	DX	.30782622 02	DY	.89430414 01	DZ	.20782219 01
R	.15188993 09	LAT	-.18866090 02	LON	.30799943 03	V	.32122684 02	PTH	.19253930 02	AZ	.78943384 02
XE	.88492690 08	YE	-.11325740 09	ZE	-.49113300 08	DXE	.23722515 02	DYE	.15814255 02	DZE	.68579680 01
XT	.88875155 08	YT	-.11328760 09	ZT	-.49164145 08	DXT	.23805288 02	DYT	.16747244 02	DZT	.72515811 01
LTE	-.18865618 02	LOE	.30800198 03	LTT	-.18852131 02	LOT	.30811451 03	RST	.15215119 09	VST	.29995789 02
EPS	.83120780 02	ESP	.27453512-18	SEP	.96876758 02	EPM	.48837777 02	EMP	.73198500 00	MEP	.13043019 03
MPS	.13183428 03	MSP	.10992114 00	SMP	.48055927 02	SEM	.13256592 03	EMS	.47326738 02	ESM	.10698938 00
RPM	.39130200 06	SPN	.69231634 01								
SAC	.58299142-10										
GCE	.27829543 03	GCT	.28210141 03	SIP	.13157979 03	CPT	.90011781 02	SIN	.89757295 02	D1	.13324878 00
REP	.65676448 04	VEP	.10950098 02	CPE	.80398073 02	CPS	.76802219 02	D2	.89358467-01	D3	.53185111-03

CASE 1 SPACE TRAJECTORIES

2 DAYS 11 HRS. 23 MIN. 24.138 SEC. 23566662C5722C2021560001 J.D.= 2438607.69676086 JULY 31,1964 04 43 20.138

GEOCENTRIC EQUATORIAL COORDINATES

X	.30123205 06	Y	.17510859 06	Z	.44375166 C5	DX	.69213917 00	DY	.55107218 00	DZ	.18901508 00
R	.35124481 06	DEC	.72579655 01	RA	.30169775 02	V	.90468994 00	PTH	.80467153 02	AZ	.59112921 02
R	.35124481 06	LAT	.72579655 01	LON	.10498424 02	VE	.25295223 02	PTE	.20213176 01	AZE	.27017432 03
XS	-.93487412 C8	YS	.1C977902 09	ZS	.47604987 08	DXS	-.22992229 02	DYS	-.16719124 02	DZS	-.72496713 01
XM	.33852305 06	YM	.16285849 06	ZM	.36673489 05	DXM	-.48995613 00	DYM	.82192130 00	DZM	.40266960 00
XT	.33852305 06	YT	.16285849 06	ZT	.36673489 C5	DXT	-.48995613 00	DYT	.82192130 00	DZT	.40266960 00
RS	.15184718 09	VS	.29338191 02	RM	.37744627 06	VM	.10381495 01	RT	.37744627 06	VT	.10381495 01
GED	.73068942 01	ALT	.34486695 06	LOS	.11074624 03	RAS	.13041759 03	RAM	.25691527 02	LOM	.60201721 01
DUT	.35000000 02	DT	.48000000 03	DR	.89219692 C0	SHA	.34835661 06	DES	.18270639 02	DEM	.55757779 01
DAC	.00000C00 C0	CCL	.25944511 03	MCL	.13177535 01	TCL	.13177535 01				

GEOCENTRIC CONIC

EPOCH OF PERICENTER PASSAGE 23566645333320257736000l J.D.= 2438605.29535873 JULY 28,1964 19 05 18.996

SMA	.27467280 06	ECC	.98727095 00	B	.43685982 05	SLR	.69481407 04	APO	.54584926 06	RCA	.34963228 04
VH	.96411978-01	C3	-.14511865 01	C1	.52626410 05	TFP	.20748114 06	TF	.17563877 01	PER	.23877159 05
TA	.17314751 03	MTA	.00000000 00	EA	.10640167 C3	MA	.52137142 02	C3J	-.19574547 01	TFI	.59390038 02

ALL VECTORS REFERENCED TO EARTH EQUATOR PLANE

X	.30123205 06	Y	.17510859 06	Z	.44375166 C5	DX	.69213917 00	DY	.55107218 00	DZ	.18901508 00
INC	.31646180 02	LAN	.18244076 02	APF	.20078576 03	MX	-.48736016 00	MY	.70933779 00	MZ	.50923444 00
WX	.16425678 00	WY	-.49829753 00	WZ	.85130432 00	PX	-.79333797 00	PY	-.57960942 00	PZ	-.18619288 00
QX	.58620342 00	QY	-.64478861 00	QZ	-.49052312 C0	RX	.15034289 00	RY	.10989989 00	RZ	-.98251320 00
BX	-.58620349 00	BY	.64478870 00	BZ	.49052319 C0	TX	-.58992531 00	TY	.80745781 00	TZ	.00000000 00
DAP	-.10730688 02	RAP	.21615171 03								
BTQ	.37851979 05	BRQ	-.21810386 05	B	.43685982 05	THA	.33004938 03				

HELIOCENTRIC EQUATORIAL COORDINATES

X	.93788644 08	Y	-.10960391 09	Z	-.47560611 08	DX	.23684368 02	DY	.17270196 02	DZ	.74386863 01
R	.15189253 09	LAT	-.18247366 02	LON	.31055378 03	V	.30241412 02	PTH	-.31613787 00	AZ	.75096856 02
XE	.93487412 C8	YE	-.10977902 09	ZE	-.47604987 08	DXE	.22992229 02	DYE	.16719124 02	DZE	.72496713 01
XT	.93825935 08	YT	-.1C961616 09	ZT	-.47568313 08	DXT	.22502273 02	DYT	.17541045 02	DZT	.76523408 01
LTE	-.18270639 02	LOE	.31041759 03	LTT	-.18246161 02	LOT	.31056187 03	RST	.15192680 09	VST	.29539785 02
EPS	.82515936 02	ESP	.13177923 00	SEP	.97352658 02	EPM	.12850096 03	EMP	.46741683 02	MEP	.47573431 01
MPS	.14897320 03	MSP	.98911702-02	SMP	.31019022 02	SEM	.10210945 03	EMS	.77751366 02	ESM	.13918114 00
RPM	.39999994 05	SPN	.81475485 02								
SAC	.58297147-10										
GCE	.10055488 03	GCT	.28187264 03	SIP	.14648291 03	CPT	.95085891 02	SIN	.92595606 02	D1	.13047324 01
REP	.35124481 06	VEP	.90468994 00	CPE	.98500405 02	CPS	.77052739 02	D2	.11426803 01	D3	.94367258-01

2 DAYS 11 HRS. 23 MIN. 24.138 SEC. 23566662057220202156000l J.D.= 2438607.69676086 JULY 31,1964 04 43 20.138
CHANGE OF PHASE CCCURS AT THIS POINT EARTH IS THE CENTRAL BODY FOR INTEGRATION COWELL EQUATIONS OF MOTION

2 DAYS 19 HRS. 23 MIN. 44.875 SEC. 23566663663720216003714l J.D.= 2438608.03033420 JULY 31,1964 12 43 40.875

GEOCENTRIC EQUATORIAL COORDINATES

X	.32423694 06	Y	.18747950 06	Z	.48415571 05	DX	.11899230 01	DY	-.10553463 01	DZ	-.28985249 00
R	.37765357 06	DEC	.73656494 01	RA	.30037253 02	V	.16166902 01	PTH	.16551153 02	AZ	.25687890 03
R	.37765356 06	LAT	.73656502 01	LON	-.24995073 03	VE	.28826756 02	PTE	.91541951 00	AZE	.26930066 03
XS	-.94148621 08	YS	.10929542 09	ZS	.47395290 08	DXS	-.22890601 02	DYS	-.16839263 02	DZS	-.73016809 01
XM	.32335556 06	YM	.18600806 06	ZM	.48150318 05	DXM	-.56216471 00	DYM	.78362978 00	DZM	.39332857 00
XT	.32335556 06	YT	.18600806 06	ZT	.48150318 05	DXT	-.56216471 00	DYT	.78362978 00	DZT	.39332857 00
RS	.15184125 09	VS	.29340330 02	RM	.37613331 06	VM	.10415431 01	RT	.37613331 06	VT	.10415431 01
GED	.74152888 01	ALT	.37127572 06	LOS	.35065555 03	RAS	.13074207 03	RAM	.29909366 02	LOM	.24982284 03
DUT	.35000000 02	DT	.30000000 02	DR	.46054859 00	SHA	.37419657 06	DES	.18188070 02	DEM	.73548432 01
DAC	.00000000 00	CCL	.25951328 03	MCL	.18748032 03	TCL	.18748032 03				

HELIOCENTRIC EQUATORIAL COORDINATES

X	.94472857 08	Y	-.10910794 09	Z	-.47346875 08	DX	.24080524 02	DY	.15783917 02	DZ	.70118284 01
R	.15189269 09	LAT	-.18162472 02	LON	.31088817 03	V	.29633923 02	PTH	.28119222 01	AZ	.74607173 02
XE	.94148621 08	YE	-.10929542 09	ZE	-.47395290 08	DXE	.22890601 02	DYE	.16839263 02	DZE	.73016809 01
XT	.94471976 08	YT	-.10910941 09	ZT	-.47347140 08	DXT	.22328437 02	DYT	.17622893 02	DZT	.76950094 01
LTE	-.18188070 02	LOE	.31074208 03	LTT	-.18162504 02	LOT	.31088753 03	RST	.15189328 09	VST	.29467586 02
EPS	.82109447 02	ESP	.14162004 00	SEP	.97758400 02	EPM	.28781878 02	EMP	.15109082 03	MEP	.12686175 00
MPS	.10992463 03	MSP	.98911702-02	SMP	.70074748 02	SEM	.97881510 02	EMS	.81977945 02	ESM	.14057998 00
RPM	.17356019 04	SPN	.81132760 02								
SAC	.58297019-10										
GCE	.10048671 03	GCT	.10796703 03	SIP	.10992463 03	CPT	.11102827 03	SIN	.11102827 03	D1	.57128389 03
REP	.37765357 06	VEP	.16166902 01	CPE	.98337663 02	CPS	.77086569 02	D2	.17481927 03	D3	-.39435102 04

SELENOCENTRIC EQUATORIAL COORDINATES

X	.88137109 03	Y	.14714414 04	Z	.26525342 03	DX	.17520877 01	DY	-.18389761 01	DZ	-.68318105 00
R	.17356019 04	DEC	.87910116 01	RA	.59079031 02	V	.26302815 01	PTH	-.17107776 02	AZ	.25685435 03
R	.17355999 04	LAT	-.12166415 02	LON	.20340361 03	VP	.26346406 01	PTP	-.17078711 02	AZP	.26757628 03
LTS	.94222630 00	LNS	.27278052 03	LTE	.58681954 01	LNE	.35481264 03				
ALT	-.23980408 01	SHA	-.16317054 04	ALP	.17580905 03	DR	-.77375009 00	DP	.82988980-01	ASD	.90000000 02
HGE	.27789955 03	SVL	-.70302282 01	HNG	.24991795 03	SIA	-.61218121 02				
SAC	.58297019-10										

SELENOCENTRIC CONIC

EPOCH OF PERICENTER PASSAGE 23566663675620231255214l J.D.= 2438608.03399981 JULY 31,1964 12 48 57.584

SMA	-.38639851 04	ECC	.14159473 01	B	.38734530 04	SLR	.38829447 04	APO	.00000000 00	RCA	.16072142 04
VH	.11264184 01	C3	.12688185 01	C1	.43631291 04	TFP	-.31670817 03	TF	.67483771 02	LTF	.67152365 02
TA	-.29098600 02	MTA	.13492988 03	EA	-.12388325 02	MA	-.52898847 01	C3J	-.19274051 01	TFI	.67395797 02
ZAE	.13386467 03	ZAP	.14411526 03	ZAC	.93066530 02	DEF	.89859775 02	IR	.40560888 04	GP	.83246089 00
OP1	.00000000 00	OY	.00000000 00	OP2	.38000000 02						

ALL VECTORS REFERENCED TO ORBIT PLANE OF TARGET

X	-.73523713 03	Y	-.15509394 04	Z	-.25754064 03	DX	-.19492388 01	DY	.17469969 01	DZ	.25855484 00
INC	.17084985 03	LAN	.17595691 03	APF	.32017186 03	MX	.86125365 00	MY	-.50307024 00	MZ	-.71047833-01
WX	.11212093-01	WY	.15862637 00	WZ	-.98727502 00	PX	-.81064188 00	PY	-.57661595 00	PZ	-.10185154 00
QX	-.58543485 00	QY	.80146844 00	QZ	.12212410 00	RX	-.14340982-01	RY	.23275427-02	RZ	-.99989441 00
BX	-.16045318 00	BY	-.97425757 00	BZ	-.15835705 00	TX	.16020382 00	TY	.98708396 00	TZ	.00000000 00
SXI	-.98697974 00	SYI	.16018690 00	SZI	.14528635-01	DAI	.83245832 00	RAI	.17078127 03		
SXO	.15803742 00	SYO	.97464663 00	SZO	.15839212 00	DAO	.91135827 01	RAO	.80789735 02		
ETE	.17919981 03	ETS	.35583666 03	ETC	.28376122 03						

CASE 1 SPACE TRAJECTORIES

BTO	-.38245674 04	BRO	.61345336 03	B	.38734534 04	THA	.17088748 03				

ALL VECTORS REFERENCED TO TRUE LUNAR EQU. PLANE

X	-.15570362 04	Y	-.67390634 03	Z	-.36578085 03	DX	-.28289038 00	DY	.26143597 01	DZ	.58958858-01
INC	.16759723 03	LAN	.10202740 03	APF	.28798141 03	MX	.83485302 00	MY	-.52807194 00	MZ	.15536693 00
WX	.21006751 00	WY	.44756255-01	WZ	-.97666192 00	PX	-.97289459 00	PY	.10835580 00	PZ	-.20429171 00
QX	.96683661-01	QY	.99310416 00	QZ	.66305153-01	RX	.60505214-01	RY	-.76247665-01	RZ	-.99525139 00
BX	-.75706211 00	BY	-.62465997 00	BZ	-.19145989 00	TX	.78333296 00	TY	.62160236 00	TZ	.00000000 00
SXI	-.61865061 00	SYI	.77961322 00	SZI	-.97337492-01	DAI	-.55858729 01	RAI	.12843324 03		
SXO	.75554883 00	SYO	.62656222 00	SZO	.19122158 00	DAO	.11024083 02	RAO	.39668271 02		
ETE	.34505075 03	ETS	.14661640 03	ETC	.23277692 03						
BTT	-.38011085 04	BRT	.74515017 03	B	.38734577 04	THA	.16890867 03				

U MATRIX FOR MAPPING FORWARD ITERATION NUMBER 3

	X	Y	Z	DX	DY	DZ	KE	RE	G
X	-.14719602 03	.10875338 02	.25615991 02	-.32595615-02	-.32476319-03	.31037056-03	.00000000 00	.00000000 00	.00000000 00
Y	-.13731668 03	.27706392 02	.49660946 02	-.29962331-02	-.12578018-03	.55986942-03	.00000000 00	.00000000 00	.00000000 00
Z	-.52840490 02	.25753844 02	-.20270947 01	-.11035822-02	.12915691-03	-.23568188-04	.00000000 00	.00000000 00	.00000000 00
DX	.14987902 06	-.25554160 04	-.24631602 05	.33314858 01	.39713632 00	-.32372415 00	.00000000 00	.00000000 00	.00000000 00
DY	-.16111938 06	.37160500 05	.42711773 05	-.34919704 01	-.72810351-01	.51352034 00	.00000000 00	.00000000 00	.00000000 00
DZ	-.10863741 06	.17132176 05	.32217422 05	-.23841064 01	-.11388957 00	.34561500 00	.00000000 00	.00000000 00	.00000000 00
KE	-.32545975 01	.52209142 00	.80158117 00	-.73065969-04	-.39913808-05	.96725029-05	.10000000 01	.00000000 00	.00000000 00
RE	-.21171868-01	.41395351-02	.33220201-02	-.10446693-05	.24882848-06	.18432593-06	.00000000 00	.10000000 01	.00000000 00
G	.65223812-01	-.49480572-01	-.25215953-01	.20072020-05	-.15301703-05	-.76044533-06	.00000000 00	.00000000 00	.10000000 01
KM	.79758912-02	-.12332462-02	-.11460148-02	.38080588-06	-.67960656-07	-.59356864-07	.00000000 00	.00000000 00	.00000000 00
RI(01)	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00
LO(01)	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00
RI(03)	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00
LA(03)	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00
LO(03)	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00
RI(04)	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00
LA(04)	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00
LO(04)	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00
RI(05)	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00
LO(05)	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00

	KM	RI(01)	LO(01)	RI(03)	LA(03)	LO(03)	RI(04)	LA(04)	LO(04)
X	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00
Y	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00
Z	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00
DX	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00
DY	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00
DZ	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00
KE	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00
RE	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00
G	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00
KM	.10000000 01	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00
RI(01)	.00000000 00	.10000000 01	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00
LO(01)	.00000000 00	.00000000 00	.10000000 01	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00
RI(03)	.00000000 00	.00000000 00	.00000000 00	.10000000 01	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00
LA(03)	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.10000000 01	.00000000 00	.00000000 00	.00000000 00	.00000000 00
LO(03)	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.10000000 01	.00000000 00	.00000000 00	.00000000 00
RI(04)	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.10000000 01	.00000000 00	.00000000 00
LA(04)	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.10000000 01	.00000000 00
LO(04)	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.10000000 01
RI(05)	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00
LO(05)	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00

	RI(05)	LO(05)
X	.00000000 00	.00000000 00
Y	.00000000 00	.00000000 00
Z	.00000000 00	.00000000 00
DX	.00000000 00	.00000000 00
DY	.00000000 00	.00000000 00
DZ	.00000000 00	.00000000 00
KE	.00000000 00	.00000000 00
RE	.00000000 00	.00000000 00
G	.00000000 00	.00000000 00
KM	.00000000 00	.00000000 00
RI(01)	.00000000 00	.00000000 00
LO(01)	.00000000 00	.00000000 00
RI(03)	.00000000 00	.00000000 00
LA(03)	.00000000 00	.00000000 00
LO(03)	.00000000 00	.00000000 00
RI(04)	.00000000 00	.00000000 00
LA(04)	.00000000 00	.00000000 00
LO(04)	.00000000 00	.00000000 00
RI(05)	.10000000 01	.00000000 00
LO(05)	.00000000 00	.10000000 01

CONDITIONS AFTER FORWARD MAPPING 64/07/28 171956.000 TO 64/07/29 102758.000

X= .15667468 06 Y= .63043005 05 Z= .80792135 04 DX= .14593175 01 DY= .98778960 00 DZ= .28737287 00

STANDARD DEVIATIONS

X= .55002608 00 Y= .18868941 01 Z= .36752176 01 DX= .66093543-05 DY= .15756591-04 DZ= .32719456-04

COVARIANCE MATRIX AFTER MAPPING ITERATION NUMBER 3

	X	Y	Z	DX	DY	DZ	KE	RE	G
X	.30252868 00	-.97532915 00	.11724207 01	.31205503-05	-.73959872-05	.80026759-05	-.11479975 00	.13854552-01	-.80316016-02
Y	-.97532915 00	.35603695 01	-.55805753 01	-.92428534-05	.26619923-04	-.40547314-04	.12355904 01	-.52365176-01	.10453919-01
Z	.11724207 01	-.55805753 01	.13507225 02	.68940546-05	-.38646001-04	.10442858-03	-.38156873 01	.10688461 00	.58438504-01
DX	.31205503-05	-.92428534-05	.68940546-05	.43683565-10	-.90717219-10	.79557373-10	-.66746527-06	.99492951-07	-.14717053-06
DY	-.73959872-05	.26619923-04	-.38646001-04	-.90717219-10	.24827016-09	-.38425991-09	.93201879-05	-.36369286-06	.45994417-07
DZ	.80026759-05	-.40547314-04	.10442858-03	.79557373-10	-.38425991-09	.10705628-08	-.30283843-04	.83532136-06	.44714390-06
KE	-.11479975 00	.12355904 01	-.38156873 01	-.66746527-06	.93201879-05	-.30283843-04	.23465833 01	-.11756211-01	.65221256-02
RE	.13854552-01	-.52365176-01	.10688461 00	.99492951-07	-.36369286-06	.83532136-06	-.11756211-01	.13176632-02	.97060890-04
G	-.80316016-02	.10453919-01	.58438504-01	-.14717053-06	.45994417-07	.44714390-06	.65221256-02	.97060890-04	.89775812-01
KM	-.59946271-01	.17019344 00	-.88679043-01	-.81013622-06	.14708519-05	-.62425256-06	.13448153-01	-.21379249-02	.44422620-02
RI(01)	.12086512-01	-.13751965-01	.48763499-01	.57543598-06	.18685316-05	-.51465294-05	.56008875-01	.40580537-04	-.53195161-03
LO(01)	-.13339052-03	.55473381-03	-.55134491-03	.15141253-09	-.13494460-08	.12093531-07	.59361497-03	.39275721-06	.21207963-04
RI(03)	.20390984-02	-.10891439-01	.33964888-01	.25202176-08	-.56368032-07	.24294704-06	-.96134286-02	.24052494-03	.32125143-04
LA(03)	-.36587529-04	.11772512-03	-.92875793-04	-.43445218-09	.10144869-08	-.65708112-09	.15511219-04	-.15129666-05	-.28041700-07
LO(03)	-.28800569-03	.10674698-02	-.19298502-02	-.24822534-08	.77924581-08	-.14900661-07	.31833395-03	-.20314296-04	.30281011-05
RI(04)	.43294151-02	-.22373741-01	.50381957-01	-.85561658-08	-.57128668-07	.19668525-06	-.20066952-01	.29635388-03	.96861058-04
LA(04)	.44586662-04	-.17261220-03	.32921882-03	.42474036-09	-.15626263-08	.19843803-08	-.78954978-04	.26220665-05	.18060700-05
LO(04)	-.30525284-03	.10582263-02	-.17040638-02	-.27091396-08	.76622416-08	-.12751728-07	.15858899-03	-.20564735-04	.44901486-05
RI(05)	.54176781-02	-.16481845-01	.23357156-01	.14208972-07	-.36927928-07	.18288466-07	.55667437-02	.36458491-03	.81797685-04
LO(05)	-.30433225-03	.10728225-02	-.17806065-02	-.27596164-08	.78265637-08	-.13376233-07	.24824384-03	-.19920318-04	.45779927-05

	KM	RI(01)	LO(01)	RI(03)	LA(03)	LO(03)	RI(04)	LA(04)	LO(04)
X	-.59946271-01	.12086512-01	-.13339052-03	.20390984-02	-.36587529-04	-.28800569-03	.43294151-02	.44586662-04	-.30525284-03
Y	.17019344 00	-.13751965-01	.55473381-03	-.10891439-01	.11772512-03	.10674698-02	-.22373741-01	-.17261220-03	.10582263-02
Z	-.88679043-01	-.48763499-01	-.55134491-03	.33964888-01	-.92875793-04	-.19298502-02	.50381957-01	.32921882-03	-.17040638-02
DX	-.81013622-06	.57543598-06	.15141253-09	.25202176-08	-.43445218-09	-.24822534-08	-.85561658-08	.42474036-09	-.27091396-08
DY	.14708519-05	.18685316-05	-.13494460-08	-.56368032-07	.10144869-08	.77924581-08	-.57128668-07	-.15626263-08	.76622416-08
DZ	-.62425256-06	-.51465294-05	.12093531-07	.24294704-06	-.65708112-09	-.14900661-07	.19668525-06	.19843803-08	-.12751728-07
KE	.13448153-01	.56008875-01	.59361497-03	-.96134286-02	.15511219-04	.31833395-03	-.20066952-01	-.78954978-04	.15858899-03
RE	-.21379249-02	.40580537-04	.39275721-06	.24052494-03	-.15129666-05	-.20314296-04	.29635388-03	.26220665-05	-.20564735-04
G	.44422620-02	-.53195161-03	.21207963-04	.32125143-04	-.28041700-07	.30281011-05	.96861058-04	.18060700-05	.44901486-05
KM	.27868181-01	-.29954928-03	.47840111-04	.72925800-04	.46100390-05	.49514367-04	-.37939258-03	-.29477555-05	.55282620-04
RI(01)	-.29954928-03	.10215977 00	-.32849937-03	.33020425-03	.87855413-06	.15896580-05	.29121702-02	.44823161-05	-.91115239-05
LO(01)	.47840111-04	-.32849937-03	.21841726-05	-.14115985-05	.23197022-07	.76188639-07	.17466902-04	-.47560248-06	.77427723-07
RI(03)	.72925800-04	.33020425-03	-.14115985-05	.33799330-02	.41481401-04	-.38096767-05	.11756580-03	.49209819-06	-.36916917-05
LA(03)	.46100390-05	.87855413-06	.23197022-07	.41481401-04	.54581121-06	.33394948-07	-.62986669-06	-.73467368-08	.30306559-07
LO(03)	.49514367-04	.15896580-05	.76188639-07	-.38096767-05	.33394948-07	.38999122-06	-.58725345-05	-.47319934-07	.37188360-06
RI(04)	-.37939258-03	.29121702-02	.17466902-04	.11756580-03	-.62986669-06	-.58725345-05	.33416819-02	-.34445197-04	-.78030309-05
LA(04)	-.29477555-05	.44823161-05	-.47560248-06	.49209819-06	-.73467368-08	-.47319934-07	-.34445197-04	.59819307-06	-.46649328-07
LO(04)	.55282620-04	-.91115239-05	.77427723-07	-.36916917-05	.30306559-07	.37188360-06	-.78030309-05	-.46649328-07	.41265651-06
RI(05)	-.54633714-03	.38130845-02	-.11245593-04	.63230936-04	-.47186493-06	-.57478552-05	.11324937-03	.18911019-05	-.67423294-05
LO(05)	.53243634-04	-.48447363-05	.93368597-07	-.42476017-05	.28521603-07	.36938152-06	-.50297353-05	-.51642048-07	.37078005-06

	RI(05)	LO(05)
X	.54176781-02	-.30433225-03
Y	-.16481845-01	.10728225-02
Z	.23357156-01	-.17806065-02
DX	.14208972-07	-.27596164-08
DY	-.36927928-07	.78265637-08
DZ	-.18288466-07	.13376233-07
KE	.55667437-02	.24824384-03
RE	.36458491-03	-.19920318-04
G	.81797685-04	.45779927-05
KM	-.54633714-03	.53243634-04
RI(01)	.38130845-02	-.48447363-05
LO(01)	-.11245593-04	.93368597-07
RI(03)	.63230936-04	-.42476017-05
LA(03)	-.47186493-06	.28521603-07
LO(03)	-.57478552-05	.36938152-06
RI(04)	.11324937-03	-.50297353-05
LA(04)	.18911019-05	-.51642048-07
LO(04)	-.67423294-05	.37078005-06
RI(05)	.64988731-03	-.62438415-05
LO(05)	-.62438415-05	.38167141-06

U MATRIX FOR MAPPING FORWARD — ITERATION NUMBER 3

	X	Y	Z	DX	DY	DZ	KE	RE	G
X	-.11448062 04	.72448142 03	.30902774 03	.53542442 00	.55168439 00	.87136456-01	.00000000 00	.00000000 00	.00000000 00
Y	-.10723203 04	.74453037 03	.32887343 03	.50067224 00	.57242389 00	.76746900-01	.00000000 00	.00000000 00	.00000000 00
Z	-.39741584 03	.30995969 03	.10593762 03	.18664819 00	.22716637 00	.53435583-01	.00000000 00	.00000000 00	.00000000 00
DX	.11676727 07	-.71882301 06	-.31162708 06	-.54600809 03	-.54885574 03	-.84070262 02	.00000000 00	.00000000 00	.00000000 00
DY	-.12499109 07	.87778018 06	.37073927 06	.58424870 03	.66873048 03	.10257482 03	.00000000 00	.00000000 00	.00000000 00
DZ	-.86893285 06	.57738296 06	.24874157 06	.39671558 03	.44137723 03	.64916755 02	.00000000 00	.00000000 00	.00000000 00
KE	-.26078957 02	.17466850 02	.74661426 01	.12189310-01	.13324538-01	.20250992-02	.10000000 01	.00000000 00	.00000000 00
RE	.12000000 02	.53375000 02	.41750000 02	.19592285-01	.26794433-01	-.14633179-01	.00000000 00	.10000000 01	.00000000 00
G	.15799942 01	-.21572266 01	-.76398849 00	-.73902680-03	-.16099661-02	-.30063837-03	.00000000 00	.00000000 00	.10000000 01
KM	.25498047 01	-.27441406 01	-.85424805 00	-.11134147-02	-.22091865-02	-.55259465-03	.00000000 00	.00000000 00	.00000000 00
RI(01)	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00
LO(01)	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00
RI(03)	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00
LA(03)	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00
LO(03)	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00
RI(04)	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00
LA(04)	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00
LO(04)	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00
RI(05)	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00
LO(05)	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00

	KM	RI(01)	LO(01)	RI(03)	LA(03)	LO(03)	RI(04)	LA(04)	LO(04)
X	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00
Y	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00
Z	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00
DX	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00
DY	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00
DZ	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00
KE	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00
RE	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00
G	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00
KM	.10000000 01	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00
RI(01)	.00000000 00	.10000000 01	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00
LO(01)	.00000000 00	.00000000 00	.10000000 01	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00
RI(03)	.00000000 00	.00000000 00	.00000000 00	.10000000 01	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00
LA(03)	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.10000000 01	.00000000 00	.00000000 00	.00000000 00	.00000000 00
LO(03)	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.10000000 01	.00000000 00	.00000000 00	.00000000 00
RI(04)	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.10000000 01	.00000000 00	.00000000 00
LA(04)	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.10000000 01	.00000000 00
LO(04)	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.10000000 01
RI(05)	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00
LO(05)	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00

	RI(05)	LO(05)
X	.00000000 00	.00000000 00
Y	.00000000 00	.00000000 00
Z	.00000000 00	.00000000 00
DX	.00000000 00	.00000000 00
DY	.00000000 00	.00000000 00
DZ	.00000000 00	.00000000 00
KE	.00000000 00	.00000000 00
RE	.00000000 00	.00000000 00
G	.00000000 00	.00000000 00
KM	.00000000 00	.00000000 00
RI(01)	.00000000 00	.00000000 00
LO(01)	.00000000 00	.00000000 00
RI(03)	.00000000 00	.00000000 00
LA(03)	.00000000 00	.00000000 00
LO(03)	.00000000 00	.00000000 00
RI(04)	.00000000 00	.00000000 00
LA(04)	.00000000 00	.00000000 00
LO(04)	.00000000 00	.00000000 00
RI(05)	.10000000 01	.00000000 00
LO(05)	.00000000 00	.10000000 01

COVARIANCE MATRIX AT IMPACT — ITERATION NUMBER 3

	X	Y	Z	DX	DY	DZ	KE	RE	G
X	.71316317 01	-.10344473 02	.14595877 01	-.24209679-02	-.67030949-02	-.53505706-02	-.23117994 00	.43820743-01	.10796695-01
Y	-.10344473 02	.16832966 02	.40015571 01	.48813794-02	.13065574-01	.44356905-02	.34221219-01	-.35257870-02	-.23041829-01
Z	.14595877 01	.40015571 01	.18678136 02	.19563870-02	.65754852-02	-.12742134-01	-.36285434 01	.12782276 00	.37198060-01
DX	-.24209679-02	.48813794-02	.19563870-02	.13502960-05	.35280002-05	.42438417-06	-.50157091-04	.84772244-05	-.40197159-05
DY	-.67030949-02	.13065574-01	.65754852-02	.35280002-05	.10047706-04	.16543620-06	-.10800606-02	.17384057-04	-.36838924-05
DZ	-.53505796-02	.44356905-02	-.12742134-01	.42438417-06	.16543620-06	.11677185-04	.27717935-02	-.10244641-03	-.37605497-04
KE	-.23117994 00	.34221219-01	-.36285434 01	-.50157091-04	-.10800606-02	.27717935-02	.23465835 01	-.11756211-01	.65221256-02
RE	.43820743-01	-.35257870-02	.12782276 00	.84772244-05	.17384057-04	-.10244641-03	-.11756211-01	.13176632-02	.97060890-04
G	.10796695-01	-.23041823-01	.37198060-01	-.40197159-05	-.36838924-05	-.37605497-04	.65221256-02	.97060890-04	.89775812-01
KM	-.31134974 00	.43043320 00	-.21908431-01	.98975594-04	.29689188-03	.19428856-03	.13448153-01	-.21379249-02	.44442620-02
RI(01)	-.85791592-01	.20569953 00	-.37009124 00	.59138791-04	-.10098474-04	.35133353-03	.56008875-01	.40580537-04	-.53195161-03
LO(01)	-.41038837-03	.71543397-03	.10299495-02	.17358964-06	.79800348-06	-.47077289-06	.59361497-03	.39275721-06	.21207963-04
RI(03)	.15244070-02	.11539189-01	.36862024-01	.42282521-05	.15634880-04	-.24079918-04	-.96134286-02	.24052494-03	.32125143-04
LA(03)	-.20369838-03	.28819935-03	-.43947821-04	.61897943-07	.19274766-06	.15294652-06	.15511219-04	-.15129666-05	-.28041700-07
LO(03)	-.10524924-02	.77795417-03	-.20132867-02	.58835240-07	.15764607-06	.18962619-05	.31833395-03	-.20314296-04	.30281011-05
RI(04)	.35741734-02	.76209624-02	.37139693-01	.46160759-05	.12504944-04	-.26640622-04	-.20066952-01	.78954978-04	.15858899-03
LA(04)	.21950854-03	-.28080583-03	.23889176-03	-.48115841-07	-.14000805-06	.29065643-06	-.78954978-04	.26220665-05	.18060700-05
LO(04)	-.11658459-02	.94596112-03	-.17540358-02	.97570515-07	.36171457-06	.17702974-05	.15858899-03	-.20564735-04	.44901486-05
RI(05)	.13707631-01	-.28981619-02	.13513065-01	.24708622-05	-.44524405-05	-.13020418-04	.55667437-02	.36458491-03	.81797685-04
LO(05)	-.11816328-02	.99346931-03	-.17891520-02	.12374134-06	.36410988-06	.18132757-05	.24824384-03	-.19920318-04	.45779927-05

	KM	RI(01)	LO(01)	RI(03)	LA(03)	LO(03)	RI(04)	LA(04)	LO(04)
X	-.31134974 00	-.85791592-01	-.41038837-03	.15244070-02	-.20369838-03	-.10524924-02	.35741734-02	.21950854-03	-.11658459-02
Y	.43043320 00	.20569953 00	.71543397-03	.11539189-01	.28819935-03	.77795417-03	.76209624-02	-.28080583-03	.94596112-03
Z	-.21908431-01	-.37009124 00	.10299495-02	.36862024-01	-.43947821-04	-.20132867-02	.37139693-01	.23889176-03	-.17540358-02
DX	.98975594-04	.59138791-04	.17358964-06	.42282521-05	.61897943-07	.58835240-07	.46160759-05	-.48115841-07	.97570515-07
DY	.29689188-03	-.10098474-04	.79800348-06	.15634880-04	.19274766-06	.15764607-06	.12504944-04	-.14000805-06	.36171457-06
DZ	.19428856-03	.35133353-03	-.47077289-06	-.24079918-04	.15294652-06	.18962619-05	-.26640622-04	.29065643-06	.17702974-05
KE	.13448153-01	.56008875-01	.59361497-03	-.96134286-02	.15511219-04	.31833395-03	-.20066952-01	.78954978-04	.15858899-03
RE	-.21379249-02	.40580537-04	.39275721-06	.24052494-03	-.15129666-05	-.20314296-04	.78954978-04	.26220665-05	-.20564735-04
G	.44442620-02	-.53195161-03	.21207963-04	.32125143-04	-.28041700-07	.30281011-05	.15858899-03	-.20564735-04	.44901486-05
KM	.27868181-01	-.29954928-03	.47840111-04	.72925800-04	.46100390-05	.49514367-04	-.37939258-03	-.29477555-05	.55282620-04
RI(01)	-.29954928-03	.10215977 00	-.32849937-03	.33020425-03	.87855413-06	.15896580-05	.29121702-02	.46823161-05	-.91115239-03
LO(01)	.47840111-04	-.32849937-03	.21841726-05	-.14115985-05	.23197022-07	.76188639-07	.17466902-04	-.47560248-06	.77427723-07
RI(03)	.72925800-04	.33020425-03	-.14115985-05	.33759330-02	.41481401-04	-.38096767-05	.11756580-03	.49209819-06	-.36916917-05
LA(03)	.46100390-05	.87855413-06	.23197022-07	.41481401-04	.54581121-06	.33394948-07	-.62986669-06	-.73467368-08	.30306559-07
LO(03)	.49514367-04	.15896580-05	.76188639-07	-.38096767-05	.33394948-07	.38999122-06	-.58725345-05	-.47319934-07	.37188360-06
RI(04)	-.37939258-03	.29121702-02	.17466902-04	.11756580-03	-.62986669-06	-.58725345-05	.33416819-02	-.34445197-04	-.78030309-05
LA(04)	-.29477555-05	.46823161-05	-.47560248-06	.49209819-06	-.73467368-08	-.47319934-07	-.34445197-04	.53815307-06	-.46649328-07
LO(04)	.55282620-04	-.91115239-03	.77427723-07	-.36916917-05	.30306559-07	.37188360-06	-.78030309-05	-.46649328-07	.41265651-06
RI(05)	.54633714-03	.38180845-02	-.11245593-04	.63230936-04	-.47186493-06	-.57478552-05	.38911019-05	.18911019-05	-.67423294-05
LO(05)	.53243634-04	-.48447363-05	.93368597-07	-.42476017-05	.28521603-07	.36938152-06	-.50297353-05	-.51642048-07	.37078005-06

	RI(05)	LO(05)
X	.13707631-01	-.11816328-02
Y	-.28981619-02	.99346931-03
Z	.13513065-01	-.17891520-02
DX	.24708622-05	.12374134-06
DY	-.44524405-05	.36410988-06
DZ	-.13020418-04	.18132757-05
KE	.55667437-02	.24824384-03
RE	.36458491-03	-.19920318-04
G	.81797685-04	.45779927-05
KM	-.54633714-03	.53243634-04
RI(01)	.38130845-02	-.48447363-05
LO(01)	-.11245593-04	.93368597-07
RI(03)	.63230936-04	-.42476017-05
LA(03)	-.47186493-06	.28521603-07
LO(03)	-.57478552-05	.36938152-06
RI(04)	.11324937-03	-.50297353-05
LA(04)	.18911019-05	-.51642048-07
LO(04)	-.67423294-05	.37078005-06
RI(05)	.64988731-03	-.62438415-05
LO(05)	-.62438415-05	.38167141-06

IMPACT PARAMETERS 64/07/31 124340

N MATRIX (TARGET ORBITAL PLANE)

	B.RO	B.TO	TL	C3	S.TS	S.RS
B.RO	.10797725 03	-.42141458 02	-.70828736-02	-.58231506-01	-.97720680-02	-.24702021-02
B.TO	-.42141455 02	.26870146 02	.32450478-02	.30892370-01	.10486382-02	.12970878-02
TL	-.70828734-02	.32450471-02	.71401307-06	.50120152-05	.19664682-05	.20351964-06
C3	-.58231506-01	.30892370-01	.50120153-05	.40896348-04	.83996087-05	.16937951-05
S.TS	-.97720660-02	.10486345-02	.19664680-05	.83996060-05	.10947644-04	.30553659-06
S.RS	-.24702029-02	.12970881-02	.20351973-06	.16937956-05	.30553670-06	.70493541-07

NORMALIZED N MATRIX

	B.RO	B.TO	TL	C3	S.TS	S.RS
B.RO	.99999999 00	-.78236318 00	-.80665954 00	-.87629358 00	-.28422352 00	-.89534764 00
B.TO	-.78236314 00	.99999999 00	.74085462 00	.93190993 00	.61140689-01	.94245298 00
TL	-.80665952 00	.74085446 00	.99999999 00	.92750665 00	.70335326 00	.90714890 00
C3	-.87629358 00	.93190995 00	.92750667 00	.10000000 01	.39696886 00	.99757130 00
S.TS	-.28422346 00	.61140472-01	.70335317 00	.39696874 00	.99999999 00	.34779891 00
S.RS	-.89534792 00	.94245320 00	.90714930 00	.99757160 00	.34779904 00	.10000000 01

DM/DQO MATRIX

	B.RO	B.TO	TL	C3	S.TS	S.RS
X	-.41490960 02	.48283439 03	.71555589 03	-.11197635-01	.49906201 00	-.35648690-02
Y	-.77556913 02	.37485842 03	.66241056 03	-.10040979-01	.51863909 00	-.33999262-02
Z	.31745284 02	.11629480 03	.23962952 03	-.35340999-02	.21265436 00	-.14141163-02
DX	.48945040 05	-.51206953 06	-.73261156 06	.11558908 02	-.49476513 03	.35861535 01
DY	-.55775649 05	.43395378 06	.77000485 06	-.11669693 02	.60923413 03	-.40259533 01
DZ	-.44701258 05	.31296403 06	.52561710 06	-.80485114 01	.40053946 03	-.27077486 01

B	.38735080 04
B.RO	.61346638 03
B.TO	-.38246207 04
B.RT	.74515017 03
B.TT	-.38011085 04
TL	.67152357 02
SMAA	.11220904 02
SMIA	.29897686 01
THETA	.66949971 02
DEL T	.30419746 01
DEL B	.11612381 02
DEL S	.34264471 01
TE	.67395797 02

N MATRIX (TARGET EQUATORIAL PLANE)

	B.RT	B.TT	TL
B.RT	.11078899 03	-.39242118 02	-.71906973-02
B.TT	-.39242115 02	.24058399 02	.29985502-02
TL	-.71906970-02	.29985496-02	.71401307-06

APPENDIX F

Ranger VII postmaneuver ODP printout

```
PAGE HEADING                                                    (23
(RA7 POST M/C WITH PRE DATA AS APRIORI 14 NOV)
EPOCH                                                           (01
 44070.2910,.2758000
PROBE POSITION AND VELOCITY AT EPOCH                            (02
X=.15667453E6 Y=.63041615E5 Z=.80777204E4
DX=.14342616E1 DY=.97256996E0 DZ=.28116199E0
OTHER PARAMETER VALUES                                          (03
KE=.39860138E6 RE=.63783085E4 GBMOON=.39225373E0
KM=.4902590+E4 RI(1)=.63756450E4 LO(1)=.2770518OE2
RI(3)=.63718804E4 LA(3)=.35117429E2 LO(3)=.24319447E3
RI(4)=.63726016E4 LA(4)=-.31212263E2 LO(4)=.13688755E3
RI(5)=.63754785E4 LO(5)=.27685332E2
RSTOP=1735.6
ARMOON=3.567 MSMOON=374.1
ESTIMATE THESE PARAMETERS                                       (04
X,Y,Z,DX,DY,DZ,KE,RE,G,KM,RI(1),LO(1)
RI(3),LA(3),LO(3),RI(4),LA(4),LO(4),RI(5),LO(5)
COVARIANCE MATRIX OF ESTIMATED PARAMETERS                       (10
 R01 2046074243771516424510707/8   6057221212015522121247572/8 $  10
     6044117274025510505747047/8   1646310117651310661700027/8 $  10
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     1734317617041405534057307/8   5725132502655371035573527/8 $  10
 R02 6057221212015522121500407/8   2074703327415447027160787/8 $  10
     6064557335305537351667427/8   5656613253765321166114367/8 $  10
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     5756204433405426357755227/8   1665013361751334006066267/8 $  10
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     5757423224625420027517507/8   1737407236721407256737157/8 $  10
 R03 6044117274025510505704207/8   6064557335305537351671047/8 $  10
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     1637171630321300021451367/8   1706222425041351534644227/8 $  10
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         1644252777701315451154 33/8      1566654641371236547207 327/8 $    10
         5617037174325264625273 407/8     1525521711661172031231 677/8 $    10
         1605522577641254633726 22/8      5644036566505315741370 527/8 $    10
         5545206044535216267156 057/8     1607277160171252760514 727/8 $    10
         5644261747215316235613 767/8     1606131347621256070477 057/8 $    10
     R19 1734317617041405534057 307/8     5757423224625420027517 507/8 $    10
         2004205515661457152235 047/8     5547100712515214764637 167/8 $    10
         5525604452035177751520 747/8     1574147160571244037650 327/8 $    10
         1767117477551432042716 527/8     1576326127721243072537 707/8 $    10
         5644605366525310310104 747/8     5735663511535405170521 517/8 $    10
         1725511123571376367012 46/8      1644424362041314321453 76/8 $     10
         5665306255065333430545 107/8     1574254452771240572156 867/8 $    10
         5614542446575265460721 44/8      1714263133261365030005 54/8 $     10
         1624015634221271753314 747/8     5644261747215316235613 767/8 $    10
         1715707002311366553502 247/8     5626011425605273132421 57/8 $     10
     R20 5725132502655371035573 527/8     1737407236721407256737 157/8 $    10
         5737425677765403003543 467/8     5524326530125177460663 037/8 $    10
         1534041673471207751556 567/8     5534063431695202322455 127/8 $    10
         1707516406541351026123 32/8      5514745251765163427113 007/8 $    10
         5506655465435151321036 507/8     1654246026341323055373 577/8 $    10
         1645502636521312575562 22/8      1574714015611247011650 05/8 $     10
         5644621076335310360227 307/8     1547552570531212445233 147/8 $    10
         1606043235201253213010 70/8      5634404507455304415436 21/8 $     10
         5535157474465207064731 657/8     1606131347621256070477 057/8 $    10
         5626011425605273132421 57/8      1606230246271256327773 16/8 $     10
NOMINAL VALUES CORRESPONDING TO COVARIENCA MATRIX                          (15
.15667409E+06 .63043567E+05 .80732194E+04
.14343088E+01 .97265000E+00 .28112921E+00
.39860177E+06 .63783253E+04 .40007859E+00
.49027693E+04 .63756696E+04 .27704883E+02
.63718724E+04 .35117447E+02 .24319473E+03
.63725922E+04 -.31212461E+02 .13688810E+03
.63754628E+04 .27685950E+02
STATISTICS,PLOT AND/OR PRINT RESIDUALS FOR THESE PARAMETERS               (14
NHR=6.
CC3(3)=.2,CC3(4)=.2,CC3(5)=.2
END DATA                                                                   (0
ODP       130220
```

INPUT COVARIANCE MATRIX OF ESTIMATED PARAMETERS ITERATION NUMBER 1

	X	Y	Z	DX	DY	DZ	KE	RE	G
X	.30720474 00	-.98617319 00	.11670562 01	.19741225-05	-.57202592-05	.12778592-04	-.11634068 00	.13977072-01	-.78394420-02
Y	-.98617319 00	.35752713 01	-.55095235 01	-.65191045-05	.22981024-04	-.46846804-04	.12319001 01	-.52329512-01	.10115762-01
Z	.11670562 01	-.55095235 01	.13175714 02	.11417489-04	-.51604056-04	.91959812-04	-.37732524 01	.10489894 00	.57592501-01
DX	.19741225-05	-.65191045-05	.11417489-04	.31561914-10	-.92764948-10	.18271681-09	.62786280-06	.18999259-06	-.18950078-06
DY	-.57202592-05	.22981024-04	-.51604056-04	-.92764948-10	.32733486-09	-.61496847-09	.71918989-05	-.64080404-06	.20024923-06
DZ	.12778592-04	-.46846804-04	.91959812-04	.18271681-09	-.61496847-09	.12080176-08	-.68522822-05	.12390531-05	.10307515-06
KE	-.11634068 00	.12319001 01	-.37732524 01	.62786280-06	.71918989-05	-.68522822-05	.23419371 01	-.11567408-01	.65543526-02
RE	.13977072-01	-.52329512-01	.10489894 00	.18999259-06	-.64080404-06	.12390531-05	-.11567408-01	.13119710-02	.97465476-04
G	-.78394420-02	.10115762-01	.57592501-01	-.18950078-06	.20024923-06	.10307515-06	.65543526-02	.97465476-04	.89780878-01
KM	.80559930-01	.17221287 00	-.91672689-01	-.44107103-06	.88424622-06	-.18684650-05	.14084781-01	-.21768502-02	.44107654-02
RI(01)	.14225339-01	-.16967811-01	.61892913-01	.23243114-07	-.88549513-07	.19183475-06	.25408360-06	.21124986-04	-.48810467-03
LO(01)	-.14435072-03	.58304517-03	-.55474857-03	.50373703-09	-.28949075-09	.70907047-09	.59854031-03	.58226750-07	.20788324-04
RI(03)	.20765293-02	-.10862372-01	.33251959-01	.23188746-07	-.11480141-06	.18885913-06	-.95430532-02	.23760432-03	.32236313-04
LA(03)	-.36596539-04	.11746452-03	-.91235793-04	-.18831129-09	.67694413-09	-.17033705-08	.15350096-04	-.15060008-05	-.28457160-07
LO(03)	-.29078066-03	.10692859-02	-.19000875-02	-.27785394-08	.91407601-08	-.17928809-07	.31607927-03	-.20245819-04	.29597577-05
RI(04)	.45227235-02	-.22675388-01	.48118591-01	.20247215-07	-.76709723-06	.25903860-06	-.12355987-01	.28858728-03	.98577405-04
LA(04)	.43163997-04	-.16896307-03	.32912927-03	.24996839-09	-.12169293-08	.23627895-08	-.78493258-04	.25863332-05	.17611151-05
LO(04)	-.30856506-03	.10621332-02	-.16784393-02	-.29917503-08	.92483084-08	-.18885885-07	.15711913-03	-.20536368-04	.43870521-05
RI(05)	.54857732-02	-.16412232-01	.21938301-01	.56438318-07	-.15791287-06	.35491922-06	.57136919-02	.35846677-03	.81461255-04
LO(05)	-.30767977-03	.10768485-02	-.17552225-02	-.27587562-08	.89323041-08	-.18017585-07	.29679526-03	-.19893423-04	.44745117-05

	KM	RI(01)	LO(01)	RI(03)	LA(03)	LO(03)	RI(04)	LA(04)	LO(04)
X	-.80559930-01	.14225339-01	-.14435072-03	.20765293-02	-.36596539-04	-.29078066-03	.45227235-02	.43163997-04	-.30856506-03
Y	.17221287 00	-.16967811-01	.58304517-03	-.10862372-01	.11746452-03	.10692859-02	-.22675388-01	-.16896307-03	.10621332-02
Z	-.91672689-01	.61892913-01	-.55474857-03	.33251959-01	-.91235793-04	-.19000875-02	.48118591-01	.32912927-03	-.16784393-02
DX	-.44107103-06	.23243114-07	.50373703-09	.23188746-07	-.18831129-09	-.27785394-08	.20247215-07	.24996839-09	-.29917503-08
DY	.88424622-06	.88549513-07	-.28949075-09	-.11480141-06	.67694413-09	.91407601-08	-.76709723-06	-.12169293-08	.92483084-08
DZ	-.18684650-05	.19183475-06	.70907047-09	.18885913-06	-.17033705-08	-.17928809-07	.25903860-06	.23627895-08	-.18885885-07
KE	.14084781-01	-.25408360-06	.59854031-03	-.95430532-02	.15350096-04	.31607927-03	-.12355987-01	-.78493258-04	.15711913-03
RE	-.21768502-02	.21124986-04	.58226750-07	.23760432-03	-.15060008-05	-.20245819-04	.28858728-03	.25863332-05	-.20536368-04
G	.44107654-02	-.48810467-03	.20788324-04	.32236313-04	-.28457160-07	.29597577-05	.98577405-04	.17611151-05	.43870521-05
KM	.27921248-01	-.67549126-03	.49064182-04	.61322793-04	.46268274-05	.50159113-04	-.42516391-03	-.27761307-05	.55941683-04
RI(01)	.67549126-03	.10247617 00	-.33324115-03	.32297482-03	.86473164-06	.11266130-05	.29005206-02	.42266982-05	-.10024439-04
LO(01)	.49064182-04	-.33324115-03	.22070999-05	-.15229741-05	.23398242-07	.84032798-07	.17008863-04	-.47299883-06	.86440001-07
RI(03)	.61322793-04	.32297482-03	-.15229741-05	.33786108-02	.41483260-04	-.37795177-05	.11475763-03	.47918949-06	-.36758463-05
LA(03)	.46268274-05	.86473164-06	.23398242-07	.41483260-04	.54581956-06	.33265724-07	-.62474258-06	-.73065404-08	.30194349-07
LO(03)	.50159113-04	.11266130-05	.84032798-07	-.37795177-05	.33265724-07	.38954860-06	-.58309820-05	-.46302864-07	.37212413-06
RI(04)	-.42516391-03	.29005206-02	.17008863-04	.11475763-03	-.62474258-06	-.58309820-05	.33338156-02	-.34490507-04	-.78184672-05
LA(04)	-.27761307-05	.42266982-05	-.47299883-06	.47918949-06	-.73065404-08	-.46302864-07	-.34490507-04	.39844912-06	.45450312-07
LO(04)	.55941683-04	-.10024439-04	.86440001-07	-.36758463-05	.30194349-07	.37212413-06	-.78184672-05	-.45450312-07	.41357024-06
RI(05)	-.56820673-03	.37927439-02	-.11445040-04	.61027022-04	-.46670453-06	-.56835691-05	.10706768-03	.18694174-05	-.67066108-05
LO(05)	.53904581-04	-.57695603-05	.10241335-06	-.42324683-05	.28413143-07	.36966674-06	-.50462727-05	-.50451321-07	.37174294-06

	RI(05)	LO(05)
X	.54857732-02	-.30767977-03
Y	-.16412232-01	.10768485-02
Z	.21938301-01	-.17552225-02
DX	.56438318-07	-.27587562-08
DY	-.15791287-06	.89323041-08
DZ	.35491922-06	-.18017585-07
KE	.57136919-02	.29679526-03
RE	.35846677-03	-.19893423-04
G	.81461255-04	.44745117-05
KM	-.56820673-03	.53904581-04
RI(01)	.37927439-02	-.57695603-05
LO(01)	-.11445040-04	.10241335-06
RI(03)	.61027022-04	-.42324683-05
LA(03)	-.46670453-06	.28413143-07
LO(03)	-.56835691-05	.36966674-06
RI(04)	.10706768-03	-.50462727-05
LA(04)	.18694174-05	-.50451321-07
LO(04)	-.67066108-05	.37174294-06
RI(05)	.69535572-03	-.62093971-05
LO(05)	-.62093971-05	.38268124-06

INPUT J MATRIX OF ESTIMATED PARAMETERS ITERATION NUMBER 1

	X	Y	Z	DX	DY	DZ	KE	RE	G
X	.85163665 03	.28502607 03	.64826412 02	-.15885398-02	-.18688031-02	.38218288-02	-.16938576 02	-.42726149 00	-.43705888 00
Y	.28502607 03	.97419929 02	.21780316 02	.10293284-03	-.15708662-02	.11024262-02	-.59156123 01	-.33349441 00	-.28163180-01
Z	.64826412 02	.21780316 02	.51994829 01	.12290161-03	-.25179789-03	-.50946106-03	-.54718344 00	.43805061-01	-.97082003-01
DX	-.15885398-02	-.10293284-03	.12290161-03	.99902673 00	.18547159-07	-.43641042-07	.19220584-03	-.62434707-04	-.71652535-04
DY	-.18688031-02	-.15708662-02	-.25179789-03	.18547159-07	.99902505 02	.11268346-06	-.67230716-04	-.39833532-04	.12679693-03
DZ	.38218288-02	.11024262-02	-.50946106-03	-.43641042-07	.11268346-06	.99902683 02	.58813088-04	.11663531-04	.29749154-04
KE	-.16938576 02	-.59156123 01	-.54718344 00	.19220584-03	-.67230716-04	.58813088-04	.35176765 01	.47396158 00	-.30384642 00
RE	-.42726149 00	-.33349441 00	.43805061-01	.62434707-04	-.39833532-04	.11663531-04	.47396158 00	.40009784 03	-.57038426-01
G	-.43705888 00	-.28163180-01	-.97082003-01	-.71652535-04	.12679693-03	.29749154-04	-.30384642 00	-.57038426-01	.11149291 02
KM	.18007366 00	.12980468 00	-.15260688-01	-.22135485-04	.12761127-04	-.51729438-05	-.11847705 00	-.36444832-01	-.21229955-01
RI(01)	-.10782327 03	-.39245117 02	-.10622564 02	.58088388-03	-.13701642-02	.30789632-02	-.71318755 01	-.91926836 00	.59659083 00
LO(01)	-.28437181 05	-.10315742 05	-.30037066 04	-.11522820-01	.11327891 00	-.29554281 00	-.20269867 04	-.24135398 03	.18845183 03
RI(03)	-.70891644 03	-.26985570 03	-.52864302 02	.69693921-04	-.35613984-03	.51655930-03	.44339909 02	.88048049 01	-.37021707 01
LA(03)	.52271594 05	.19899454 05	.38980086 04	-.51511596-02	-.26291696-01	-.38162788-01	-.32690190 04	-.64895821 03	.27209906 03
LO(03)	.34086107 05	.12611852 05	.25281102 04	-.11077779-02	.11316003-01	-.11257481-01	-.22026153 04	-.47260125 03	.18999539 03
RI(04)	.11831728 03	.52898314 02	.16877373 02	.20028888-02	-.39329205-02	.11454651-01	.39855759 02	.57312676 01	-.34441351 01
LA(04)	-.16824338 05	-.53803270 04	-.14538103 04	.95764393-01	-.74893890-01	.49193035 00	.95451954 03	.18917175 03	-.69491098 02
LO(04)	-.31789982 04	-.13417878 04	-.30710945 03	.20130501 00	-.28857568 00	.10977378 01	.54536321 04	.68307578 03	-.51916444 03
RI(05)	-.93882275 01	.11580372 01	-.10983517 02	.84427038-03	-.21964951-02	.51179748-02	-.32077143 02	-.66824017 01	.49952787 01
LO(05)	.15515472 06	.46236359 05	.11420230 05	.70156812-01	-.13883021 00	.40077712 00	-.36505401 04	.48008971 03	-.26731182 03

	KM	RI(01)	LO(01)	RI(03)	LA(03)	LO(03)	RI(04)	LA(04)	LO(04)
X	.18007366 00	-.10782327 03	-.28437181 05	-.70891644 03	.52271594 05	.34086107 05	.11831728 03	-.16824338 05	-.31989982 04
Y	.12980468 00	-.39245117 02	-.10315742 05	-.26985570 03	.19899454 05	.12611852 05	.52898314 02	-.53803270 04	-.13417877 04
Z	-.15260688-01	-.10622564 02	-.30037066 04	-.52864302 02	.38980086 04	.25281102 04	.16877373 02	-.14538103 04	.82716845 03
DX	-.22135485-04	.58088388-03	-.11522820-01	.69693921-04	-.51511596-02	-.11077779-02	.20028888-02	.95764393-01	.20130501 00
DY	.12761127-04	-.13701642-02	.11327891 00	-.35613984-03	.26291696-01	.11316003-01	-.39329205-02	-.74893890-01	-.28857568 00
DZ	-.51729438-05	.30789632-02	-.29554281 00	.51655930-03	-.38162788-01	-.11257481-01	.11454651-01	.49193035 00	.10977378 01
KE	-.17847705 00	-.71318755 01	-.20269867 04	.44339909 02	-.32690150 04	-.22026153 04	.39855759 02	.95451954 03	.54536321 04
RE	-.36444832-01	-.91926836 00	-.24135398 03	.88048049 01	-.64895821 03	-.47260125 03	.57312676 01	.18917175 03	.68307578 03
G	.21229955-01	.59659083 00	.18845183 03	-.37021707 01	.27209906 03	.18999539 03	-.34441351 01	-.69491098 02	-.51916444 03
KM	.53578097-01	.34664852 00	.91178983 02	-.32749304 01	.24138124 03	.17534560 03	-.21626042 01	-.71151700 02	-.25848354 03
RI(01)	.34664852 00	-.76504936 02	.16271992 05	.10387106 02	-.76509416 05	-.54090495 05	-.21371102 03	-.43902879 03	.15809945 05
LO(01)	.91178983 02	.16271992 05	.44584900 07	.11263179 05	-.83060753 06	-.51771580 06	-.44771042 05	.69709881 06	-.35936073 07
RI(03)	-.32749304 01	.10387106 02	.11263179 05	.19337401 04	-.13495184 06	-.85991383 05	.14181401 03	.21901966 05	.28513988 05
LA(03)	.24138124 03	-.76509416 03	-.83060753 06	-.13495184 06	.11167555 08	.63354071 07	-.10453449 05	-.16148046 07	-.21021726 07
LO(03)	.17534560 03	-.54090496 03	-.51771580 06	-.85991383 05	.63354071 07	.52069057 07	-.73938430 04	-.10766111 07	-.14249735 07
RI(04)	-.21626042 01	-.21371102 03	-.44771042 05	.14181401 03	-.10453449 05	-.73938430 04	.11753717 04	.32043860 05	.94880682 05
LA(04)	-.71151700 02	-.43902879 03	.69709881 06	.21901966 05	-.16148046 07	-.10766111 07	.32043860 05	.38547985 07	.27913303 07
LO(04)	-.25848354 03	-.15809945 05	-.35936073 07	.28513988 05	-.21021726 07	-.14249735 07	.94880682 05	.27913303 07	.14245128 08
RI(05)	.24987148 01	-.47263028 02	.12143414 05	-.12203543 02	.90126955 03	.32313102 03	-.20702050 03	-.75700005 04	-.18564167 05
LO(05)	-.16760579 03	-.11211580 05	-.34050930 07	.48244372 04	-.35561785 06	-.25206016 06	-.56762017 05	-.61964460 07	-.89941672 07

	RI(05)	LO(05)
X	-.93882275 01	.15515472 06
Y	.11580372 01	.46236359 05
Z	-.10983517 02	.11420230 05
DX	.84427038-03	.70156812-01
DY	-.21964951-02	-.13883021 00
DZ	.51179748-02	.40077712 00
KE	-.32077143 02	-.36505401 04
RE	-.66824017 01	.48008971 03
G	.49952787 01	-.26731182 03
KM	.24987148 01	-.16760579 03
RI(01)	-.47263028 02	-.11211580 05
LO(01)	.12143414 05	-.34050930 07
RI(03)	-.12203543 02	.48244372 04
LA(03)	.90126955 03	-.35561785 06
LO(03)	.32313102 03	-.25206016 06
RI(04)	-.20702050 03	-.56762017 05
LA(04)	-.75700005 04	-.61964460 07
LO(04)	-.18564167 05	-.89941672 07
RI(05)	.19996329 04	-.78609341 04
LO(05)	-.78609341 04	.56974344 08

CASE 1 SPACE TRAJECTORIES

EPHEMERIS TAPE IV WITH MARS VELOCITIES. B-8 IS

GME	.39860138 06	J	.16234500-02	H	-.57499999-05	D	.78749999-05	RE	.63781650 04	REM	.63783080 04
G	.66709998-19	A	.88782497 29	B	.88800499 29	C	.88837498 29	OME	.41780741-02	AU	.14959900 09
GMM	.49025898 04	GMS	.13271544 12	GMV	.32476952 06	GMA	.42977799 05	GMC	.37918700 08	GMJ	.12671062 09
EGM	.39860320 06	MGM	.49027779 04	JA	.29200000-02	HA	.00000000 00	DA	.00000000 00	RA	.34170000 04
ARA	.35670000 01	GB	.39220320 00	MAS	.37410000 03	GB1	.00000000 00	GB2	.00000000 00	SC	.10200000 09

INJECTION CONDITIONS MOON 2356665063532024000000000 J.D.= 2438605.93608796 JULY 29,1964 10 27 58.000

GEOCENTRIC XO .15667452 06 YO .63041636 05 ZO .80776752 04 DXO .14342615 01 DYO .97257024 00 DZO .28116142 00
CARTESIAN GMC .00000000 00 SGC .00000000 00 TO .37678000 05 GHA .10409373 03 GHO .30667226 03
DATE OF RUN 111464A 000000 EARTH IS THE CENTRAL BODY FOR INTEGRATION COWELL EQUATIONS OF MOTION

0 DAYS 0 HRS. 0 MIN. 0.000 SEC. 2356665063532024000000000 J.D.= 2438605.93608796 JULY 29,1964 10 27 58.000

GEOCENTRIC EQUATORIAL COORDINATES

X	.15667452 06	Y	.63041634 05	Z	.80776751 04	DX	.14342615 01	DY	.97257021 00	DZ	.28116141 00
R	.16907513 06	DEC	.27383850 01	RA	.21918537 02	V	.17555770 01	PTH	.76231921 02	AZ	.61412219 02
R	.16907513 06	LAT	.27383850 01	LON	.27782480 03	VE	.12070910 02	PTE	.81207508 01	AZE	.27095862 03
XS	-.89949617 08	YS	.11227379 09	ZS	.48686774 08	DXS	-.23516068 02	DYS	-.16077728 02	DZS	-.69720238 01
XM	.38246390 06	YM	.27456503 05	ZM	-.26012533 05	DXM	-.83439838-01	DYM	.93230140 00	DZM	.40985468 00
XT	.38246390 06	YT	.27456503 05	ZT	-.26012533 05	DXT	-.83439838-01	DYT	.93230140 00	DZT	.40985468 00
RS	.15187738 09	VS	.29327596 02	RM	.38432947 06	VM	.10218263 01	RT	.38432947 06	VT	.10218263 01
GED	.27570178 01	ALT	.16269697 06	LOS	.24606686 02	RAS	.12870042 03	RAM	.41061312 01	LOM	.26001239 03
DUT	.35000000 02	DT	.12000000 03	DR	.17051341 01	SHA	.16335721 06	DES	.18697176 02	DEM	-.38809100 01
DAC	.00000000 00	CCL	.25840728 03	MCL	.11049367 00	TCL	.11049367 00				

GEOCENTRIC CONIC

EPOCH OF PERICENTER PASSAGE 2356664500622026250000000 J.D.= 2438605.21642558 JULY 28,1964 17 11 39.170

SMA	.24408708 06	ECC	.97401691 00	B	.55279673 05	SLR	.12519484 05	APO	.48183202 06	RCA	.63421363 04
VH	.14661113 00	C3	-.16330294 01	C1	.70641940 05	TFP	.62178830 05	TF	-.17271897 02	PER	.20002138 05
TA	.16192552 03	MTA	.00000000 00	EA	.71608130 02	MA	.18651655 02	C3J	-.20370906 01	TFI	.00000000 00

ALL VECTORS REFERENCED TO EARTH EQUATOR PLANE

X	.15667452 06	Y	.63041634 05	Z	.80776751 04	DX	.14342615 01	DY	.97257021 00	DZ	.28116141 00
INC	.28707647 02	LAN	.16908152 02	APF	.20378266 03	MX	-.34898680 00	MY	.80607918 00	MZ	.47795805 00
WX	.13970127 00	WY	-.45957585 00	WZ	.87708205 00	PX	-.77265532 00	PY	-.60455085 00	PZ	-.19370598 00
QX	.61926342 00	QY	-.65062106 00	QZ	-.43955022 00	RX	.15255746 00	RY	.11936595 00	RZ	-.98105961 00
BX	-.61926362 00	BY	.65062128 00	BZ	.43955037 00	TX	-.61622234 00	TY	.78757224 00	TZ	.00000000 00
DAP	-.11169141 02	RAP	.21804079 03								
BTQ	.49420875 05	BRQ	-.24767304 05	B	.55279673 05	THA	.33338223 03				

HELIOCENTRIC EQUATORIAL COORDINATES

X	.90106291 08	Y	-.11221075 09	Z	-.48678696 08	DX	.24950329 02	DY	.17050298 02	DZ	.72531852 01
R	.15192106 09	LAT	-.18688384 02	LON	.30876480 03	V	.31077971 02	PTH	-.21990135 00	AZ	.75813411 02
XE	.89949617 08	YE	-.11227379 09	ZE	-.48686774 08	DXE	.23516068 02	DYE	.16077728 02	DZE	.69720238 01
XT	.90332080 08	YT	-.11224633 09	ZT	-.48712787 08	DXT	.23432628 02	DYT	.17010029 02	DZT	.73818785 01
LTE	-.18697176 02	LOE	.30870042 03	LTT	-.18680127 02	LOT	.30882594 03	RST	.15209227 09	VST	.29881788 02
EPS	.74995023 02	ESP	.60570802-01	SEP	.10494336 03	EPM	.14723360 03	EMP	.13773992 02	MEP	.18992400 02
MPS	.13777124 03	MSP	.57674939-01	SMP	.42170243 02	SEM	.12393571 03	EMS	.55944169 02	ESM	.11992408 00
RPM	.23110450 06	SPN	.72833151 02								
SAC	.58665419-10										
GCE	.10159272 03	GCT	.28170321 03	SIP	.13734035 03	CPT	.92025128 02	SIN	.91594236 02	D1	.22561861 00
REP	.16907513 06	VEP	.17555770 01	CPE	.97484330 02	CPS	.76877848 02	D2	.16806176 00	D3	.18732549-02

1 DAYS 19 HRS. 5 MIN. 21.124 SEC. 2356666221472026177000000 J.D.= 2438607.73147134 JULY 31,1964 05 33 19.124

GEOCENTRIC EQUATORIAL COORDINATES

X	.29850499 06	Y	.17412140 06	Z	.43994121 05	DX	.64990290 00	DY	.52828979 00	DZ	.18216474 00
R	.34836615 06	DEC	.72550866 01	RA	.30255502 02	V	.85711601 00	PTH	.79940546 02	AZ	.59406059 02
R	.34836614 06	LAT	.72550866 01	LON	.35805416 03	VE	.25085318 02	PTE	.19279506 01	AZE	.27017413 03
XS	-.93556354 08	YS	.10972886 09	ZS	.47583237 08	DXS	-.22981690 02	DYS	-.16731646 02	DZS	-.72550923 01
XM	.33704213 06	YM	.16531779 06	ZM	.37879808 05	DXM	-.49758344 00	DYM	.81818858 00	DZM	.40181758 00
XT	.33704213 06	YT	.16531779 06	ZT	.37879808 05	DXT	-.49758344 00	DYT	.81818858 00	DZT	.40181758 00
RS	.15184656 09	VS	.29338412 02	RM	.37730922 06	VM	.10384985 01	RT	.37730922 06	VT	.10384985 01
GED	.73039963 01	ALT	.34198828 06	LOS	.98250033 02	RAS	.13045137 03	RAM	.26127762 02	LOM	.35392642 03
DUT	.35000000 02	DT	.48000000 03	DR	.84393961 00	SHA	.34553736 06	DES	.18262074 02	DEM	.57618946 01
DAC	.00000000 00	CCL	.25940594 03	MCL	.24399954 00	TCL	.24399954 00				

GEOCENTRIC CONIC

EPOCH OF PERICENTER PASSAGE 2356664533342027657000000 J.D.= 2438605.29541574 JULY 28,1964 19 05 23.921

SMA	.25654037 06	ECC	.98661000 00	B	.41841011 05	SLR	.68241528 04	APO	.50964566 06	RCA	.34350742 04
VH	.10233529 00	C3	-.15537569 01	C1	.52154738 05	TFP	.21047520 06	TF	-.15376133 02	PER	.21552259 05
TA	.17357379 03	MTA	.00000000 00	EA	.11127205 03	MA	.58594841 02	C3J	-.20580706 01	TFI	.43089201 02

ALL VECTORS REFERENCED TO EARTH EQUATOR PLANE

X	.29850499 06	Y	.17412140 06	Z	.43994121 05	DX	.64990290 00	DY	.52828979 00	DZ	.18216474 00
INC	.31361147 02	LAN	.18198797 02	APF	.20046971 03	MX	-.48923677 00	MY	.71115936 00	MZ	.50487547 00
WX	.16253817 00	WY	-.49439760 00	WZ	.85390389 00	PX	-.79673050 00	PY	-.57627785 00	PZ	-.18200096 00
QX	.58206682 00	QY	-.65074913 00	QZ	-.48756878 00	RX	.14746864 00	RY	.10666456 00	RZ	-.98329834 00
BX	-.58206696 00	BY	.65074929 00	BZ	.48756889 00	TX	-.58606612 00	TY	.81026323 00	TZ	.00000000 00
DAP	-.10486329 02	RAP	.21587834 03								
BTQ	.36335066 05	BRQ	-.20746882 05	B	.41841011 05	THA	.33027416 03				

HELIOCENTRIC EQUATORIAL COORDINATES

X	.93854858 08	Y	-.10955474 09	Z	-.47539242 08	DX	.23631593 02	DY	.17259936 02	DZ	.74372569 01
R	.15189126 09	LAT	-.18239035 02	LON	.31058646 03	V	.30193879 02	PTH	-.33143919 00	AZ	.75081515 02
XE	.93556354 08	YE	-.10972886 09	ZE	-.47583237 08	DXE	.22981690 02	DYE	.16731646 02	DZE	.72550923 01
XT	.93893396 08	YT	-.10956354 09	ZT	-.47545357 08	DXT	.22484106 02	DYT	.17549835 02	DZT	.76569098 01
LTE	-.18262074 02	LOE	.31045137 03	LTT	-.18237476 02	LOT	.31059580 03	RST	.15192334 09	VST	.29532355 02
EPS	.82563078 02	ESP	.13028593 00	SEP	.97306579 02	EPM	.13412485 03	EMP	.41510753 02	MEP	.43643786 01
MPS	.14331163 03	MSP	.98911702-02	SMP	.36679353 02	SEM	.10167094 03	EMS	.78189707 02	ESM	.13935676 00
RPM	.39999994 05	SPN	.81514030 02								
SAC	.58668444-10										
GCE	.10059405 03	GCT	.28083805 03	SIP	.14082134 03	CPT	.94021796 02	SIN	.91531510 02	D1	.13047324 01
REP	.34836615 06	VEP	.85711601 00	CPE	.98550266 02	CPS	.77055966 02	D2	.10732508 01	D3	.76185489-01

1 DAYS 19 HRS. 5 MIN. 21.124 SEC. 2356666221472026177000000 J.D.= 2438607.73147134 JULY 31,1964 05 33 19.124
CHANGE OF PHASE OCCURS AT THIS POINT EARTH IS THE CENTRAL BODY FOR INTEGRATION COWELL EQUATIONS OF MOTION

2 DAYS 2 HRS. 57 MIN. 50.736 SEC. 2356666400272021361214 61 J.D.= 2438608.05959184 JULY 31,1964 13 25 48.736

CASE 1 SPACE TRAJECTORIES

GEOCENTRIC — EQUATORIAL COORDINATES

X	.32029139 06	Y	.18771491 06	Z	.48627676 05	DX	.20228715 01	DY	.43325295 00	DZ	.28010776 00
R	.37441702 06	DEC	.74624110 01	RA	.30373517 02	V	.20876249 01	PTH	.71875013 02	AZ	.27199611 03
R	.37441702 06	LAT	.74624110 01	LON	.23972541 03	VE	.27791638 02	PTE	.40938121 01	AZE	.27004676 03
XS	-.94206473 08	YS	.10925284 09	ZS	.47376826 08	DXS	-.22881651 02	DYS	-.16849780 02	DZS	-.73062335 01
XM	.32192653 06	YM	.18798435 06	ZM	.49143397 05	DXM	-.56837358 00	DYM	.78001519 00	DZM	.39238635 00
XT	.32192653 06	YT	.18798435 06	ZT	.49143397 05	DXT	-.56837358 00	DYT	.78001519 00	DZT	.39238635 00
RS	.15184073 09	VS	.29340519 02	RM	.37601846 06	VM	.10418442 01	RT	.37601846 06	VT	.10418442 01
GED	.75126868 01	ALT	.36803918 06	LOS	.34012241 03	RAS	.13077052 03	RAM	.30282173 02	LOM	.23963406 03
DUT	.35000000 02	DT	.30000000 02	DR	.19840373 01	SHA	.37126506 06	DES	.18180800 02	DEM	.75097058 01
DAC	.00000000 00	CCL	.25948618 03	MCL	.34215978 03	TCL	.34215978 03				

HELIOCENTRIC — EQUATORIAL COORDINATES

X	.94526764 08	Y	-.10906513 09	Z	-.47328198 08	DX	.24904522 02	DY	.17283033 02	DZ	.75863412 01
R	.15188966 09	LAT	-.18155433 02	LON	.31091548 03	V	.31248856 02	PTH	.13294280 01	AZ	.74741732 02
XE	.94206473 08	YE	-.10925284 09	ZE	-.47376826 08	DXE	.22881651 02	DYE	.16849780 02	DZE	.73062335 01
XT	.94528399 08	YT	-.10906486 09	ZT	-.47327682 08	DXT	.22313277 02	DYT	.17629795 02	DZT	.76986198 01
LTE	-.18180800 02	LOE	.31077052 03	LTT	-.18155146 02	LOT	.31091604 03	RST	.15189032 09	VST	.29461173 02
EPS	.82420258 02	ESP	.14023158 00	SEP	.97439692 02	EPM	.15727327 03	EMP	.22624560 02	MEP	.10207574 00
MPS	.11247367 03	MSP	.27453512-18	SMP	.67525719 02	SEM	.97509209 02	EMS	.82350163 02	ESM	.14110097 00
RPM	.17355914 04	SPN	.81444207 02								
SAC	.58689680-10										
GCE	.10051381 03	GCT	.26267359 03	SIP	.11247367 03	CPT	.10155258 03	SIN	.10155258 03	D1	.57002702 03
REP	.37441702 06	VEP	.20876249 01	CPE	.98443462 02	CPS	.77089278 02	D2	.15380381 03	D3	-.44806634 04

SELENOCENTRIC — EQUATORIAL COORDINATES

X	-.16351484 04	Y	-.26944140 03	Z	-.51572119 03	DX	.25912451 01	DY	-.34676224 00	DZ	-.11227859 00
R	.17355914 04	DEC	-.17286166 02	RA	.18935717 03	V	.26167540 01	PTH	-.64108317 02	AZ	.13807651 03
R	.17355978 04	LAT	-.10702065 02	LON	.33933167 03	VP	.26149379 01	PTP	-.64190488 02	AZP	.11489072 03
LTS	.94280089 00	LNS	.27242310 03	LTE	.58450094 01	LNE	.35482939 03				
ALT	-.24086304 01	SHA	-.16037753 04	ALP	.51317579 01	DR	-.23540874 01	DP	.37721811-01	ASD	.90000000 02
HGE	.27757974 03	SVL	-.16445120 02	HNG	.11348841 03	SIA	.67273270 02				
SAC	.58689680-10										

SELENOCENTRIC CONIC

EPOCH OF PERICENTER PASSAGE 2356666402462022234142061 J.D.= 2438608.06621782 JULY 31,1964 13 35 21.220

SMA	-.40925620 04	ECC	.10936287 01	B	.18119645 04	SLR	.80223978 03	APO	.00000000 00	RCA	.38318149 03
VH	.10944984 01	C3	.11979268 01	CI	.19831925 04	TFP	-.57248462 03	TF	.51123116 02	LTF	.51030153 02
YA	-.11945444 03	MTA	.15611883 03	EA	-.43489393 02	MA	-.87721557 01	C3J	-.21691096 01	TFI	.50964093 02
ZAE	.13175616 03	ZAP	.14584333 03	ZAC	.93425516 02	DEF	.13223766 03	IR	.41528773 04	GP	.78468457 00
OP1	.00000000 00	OY	.00000000 00	OP2	.38000000 02						

ALL VECTORS REFERENCED TO ORBIT PLANE OF TARGET

X	.15283784 04	Y	.64237957 03	Z	-.51350307 03	DX	-.26025235 01	DY	.46403378-01	DZ	.26855069 00
INC	.28508090 02	LAN	.16802832 03	APF	.33776305 03	MX	-.23160707-02	MY	-.79847646 00	MZ	.42451182 00
WX	.99001862-01	WY	.44690211 00	WZ	.87874972 00	PX	-.83651419 00	PY	.51731984 00	PZ	-.18062169 00
QX	-.53892729 00	QY	-.71720470 00	QZ	.44178585 00	RX	-.13464395-01	RY	.25019707-02	RZ	-.99990620 00
BX	.15413292 00	BY	.86523502 00	BZ	-.47708635 00	TX	.18269385 00	TY	.98316985 00	TZ	.00000000 00
SXI	-.98307765 00	SYI	.18267671 00	SZI	.13694882-01	DAI	.78468371 00	RAI	.16947329 03		
SXO	.54671790 00	SYO	-.76338446 00	SZO	.34401118 00	DAO	.20121445 02	RAO	.30560934 03		
ETE	.17929943 03	ETS	.35560455 03	ETC	.28369052 03						

BTO .15924129 04 BRO .86454476 03 B .18119648 04 THA .28498194 02

ALL VECTORS REFERENCED TO TRUE LUNAR EQU. PLANE

X	.15956477 04	Y	-.60193710 03	Z	-.32230403 03	DX	-.18813906 01	DY	.18184154 01	DZ	-.33685252-01
INC	.26870319 02	LAN	.13743110 03	APF	.32371395 03	MX	-.39575187-01	MY	-.74955616 00	MZ	.26613248 00
WX	.30574880 00	WY	.33286191 00	WZ	.89203177 00	PX	-.23651903 00	PY	.93408272 00	PZ	-.26746502 00
QX	-.92226699 00	QY	-.12919931 00	QZ	.36432284 00	RX	.57520641-01	RY	-.78217424-01	RZ	-.99527550 00
BX	.74755455 00	BY	.49629570 00	BZ	-.44142131 00	TX	.80561252 00	TY	.59244279 00	TZ	.00000000 00
SXI	-.58964381 00	SYI	.80180642 00	SZI	-.97090627-01	DAI	-.55716610 01	RAI	.12633055 03		
SXO	-.15710452 00	SYO	-.90641753 00	SZO	.39207839 00	DAO	.23083884 02	RAO	.26016691 03		
ETE	.34498688 03	ETS	.14469923 03	ETC	.23295811 03						
BTT	.16239902 04	BRT	.80363043 03	B	.18119509 04	THA	.26328474 02				

2 DAYS 2 HRS. 57 MIN. 50.736 SEC. 2356666400272021361214 61 J.D.= 2438608.05959184 JULY 31,1964 13 25 48.736
CHANGE OF PHASE OCCURS AT THIS POINT EARTH IS THE CENTRAL BODY FOR INTEGRATION COWELL EQUATIONS OF MOTION

2 DAYS 2 HRS. 58 MIN. 3.446 SEC. 2356666400322022711062 70 J.D.= 2438608.05973896 JULY 31,1964 13 26 01.446

GEOCENTRIC — EQUATORIAL COORDINATES

X	.32031722 06	Y	.18772044 06	Z	.48631275 05	DX	.20426511 01	DY	.43655695 00	DZ	.28642609 00
R	.37444236 06	DEC	.74624588 01	RA	.30372237 02	V	.21083276 01	PTH	.71852001 02	AZ	.27230830 03
R	.37444235 06	LAT	.74624597 01	LON	.23967102 03	VE	.27801945 02	PTE	.41323993 01	AZE	.27005465 03
XS	-.94206764 08	YS	.10925263 09	ZS	.47376733 08	DXS	-.22881605 02	DYS	-.16849832 02	DZS	-.73062563 01
XM	.32191931 06	YM	.18799427 06	ZM	.49148384 05	DXM	-.56840474 00	DYM	.77999692 00	DZM	.39238157 00
XT	.32191931 06	YT	.18799427 06	ZT	.49148384 05	DXT	-.56840474 00	DYT	.77999692 00	DZT	.39238157 00
RS	.15184072 09	VS	.29340519 02	RM	.37601788 06	VM	.10418457 01	RT	.37601788 06	VT	.10418457 01
GED	.75127357 01	ALT	.36806452 06	LOS	.34006944 03	RAS	.13077066 03	RAM	.30284047 02	LOM	.23958283 03
DUT	.35000000 02	DT	.52107661 01	DR	.20034491 01	SHA	.37128907 06	DES	.18180764 02	DEM	.75104836 01
DAC	.00000000 00	CCL	.25948661 03	MCL	.34198665 03	TCL	.34198665 03				

HELIOCENTRIC — EQUATORIAL COORDINATES

X	.94527081 08	Y	-.10906491 09	Z	-.47328101 08	DX	.24924256 02	DY	.17286389 02	DZ	.75926824 01
R	.15188967 09	LAT	-.18155394 02	LON	.31091563 03	V	.31267980 02	PTH	.13432352 01	AZ	.74733561 02
XE	.94206764 08	YE	-.10925263 09	ZE	-.47376733 08	DXE	.22881605 02	DYE	.16849832 02	DZE	.73062563 01
XT	.94528683 08	YT	-.10906463 09	ZT	-.47327584 08	DXT	.22313200 02	DYT	.17629829 02	DZT	.76986378 01
LTE	-.18180764 02	LOE	.31077066 03	LTT	-.18155110 02	LOT	.31091618 03	RST	.15189031 09	VST	.29461141 02
EPS	.82418928 02	ESP	.13988231 00	SEP	.97441012 02	EPM	.15742806 03	EMP	.22472177 02	MEP	.99405042-01
MPS	.11201326 03	MSP	.27453512-18	SMP	.67986140 02	SEM	.97507337 02	EMS	.82352034 02	ESM	.14057998 00
RPM	.17056085 04	SPN	.81442942 02								
SAC	.58689674-10										
GCE	.10051338 03	GCT	.26250002 03	SIP	.11201326 03	CPT	.10163627 03	SIN	.10163627 03	D1	.15611640 03
REP	.37444236 06	VEP	.21083276 01	CPE	.98442715 02	CPS	.77089293 02	D2	.20720501 03	D3	-.32846401 03

SELENOCENTRIC — EQUATORIAL COORDINATES

X	-.16020976 04	Y	-.27382812 03	Z	-.51710888 03	DX	.26110558 01	DY	-.34343996 00	DZ	-.10595548 00
R	.17056085 04	DEC	-.17648789 02	RA	.18969918 03	V	.26356764 01	PTH	-.63822186 02	AZ	.13797364 03
R	.17056035 04	LAT	-.10906361 02	LON	.33978083 03	VP	.26338731 01	PTP	-.63902027 02	AZP	.11480232 03
LTS	.94280430 00	LNS	.27242131 03	LTE	.58448925 01	LNE	.35482948 03				
ALT	-.32391510 02	SHA	-.15812580 04	ALP	.51008391 01	DR	-.23653332 01	DP	.39059785-01	ASD	.90000000 02
HGE	.27758107 03	SVL	-.16660146 02	HNG	.11303198 03	SIA	.67428062 02				
SAC	.58689674-10										

CASE 1 SPACE TRAJECTORIES

SELENOCENTRIC CONIC

EPOCH OF PERICENTER PASSAGE 2356666402462022343670 J.D.= 2438608.06621785 JULY 31,1964 13 35 21.222

SMA	-.40923017 04	ECC	.10936349 01	B	.18119113 04	SLR	.80224361 03	APO	.00000000 00	RCA	.38318219 03
VH	.10945332 01	C3	.11980030 01	C1	.19831972 04	TFP	-.55977584 03	TF	.51123117 02	LTF	.51030157 02
TA	-.11896641 03	MTA	.15611811 03	EA	-.43027463 02	MA	-.85782381 01	C3J	-.21707725 01	TFI	.50967623 02
ZAE	.13175450 03	ZAP	.14584314 03	ZAC	.93425743 02	DEF	.13223621 03	IR	.41527683 04	GP	.78500558 00
OP1	.00000000 00	OY	.00000000 00	OP2	.76000000 02						

ALL VECTORS REFERENCED TO ORBIT PLANE OF TARGET

X	.14951697 04	Y	.64297388 03	Z	-.51005141 03	DX	-.26210278 01	DY	.38446821-01	DZ	.27481774 00
INC	.28507907 02	LAN	.16803009 03	APF	.33776301 03	MX	-.47645158-03	MY	-.79541015 00	MZ	.42267499 00
WX	.98986872-01	WY	.46690253 00	WZ	.87875125 00	PX	-.83652968 00	PY	.51729508 00	PZ	-.18062099 00
QX	-.53890600 00	QY	-.71722238 00	QZ	.44178322 00	RX	-.13470000-01	RY	.25024353-02	RZ	-.99990611 00
BX	.15409478 00	BY	.86524342 00	BZ	-.47708347 00	TX	.18265315 00	TY	.98317742 00	TZ	.00000000 00
SXI	-.98308511 00	SYI	.18263600 00	SZI	.13700478-01	DAI	.78500303 00	RAI	.16947566 03		
SXO	.54673020 00	SYO	-.76337459 00	SZO	.34401364 00	DAO	.20121595 02	RAO	.30561030 03		
ETE	.17929918 03	ETS	.35560502 03	ETC	.28369054 03						
BTO	.15923687 04	BRO	.86451402 03	B	.18119113 04	THA	.28498008 02				

ALL VECTORS REFERENCED TO TRUE LUNAR EQU. PLANE

X	.15715911 04	Y	-.57883000 03	Z	-.32270775 03	DX	-.19007108 01	DY	.18257060 01	DZ	-.29734712-01
INC	.26870192 02	LAN	.13742901 03	APF	.32371397 03	MX	.42298317-01	MY	-.74519600 00	MZ	.26356072 00
WX	.30975956 00	WY	.33284923 00	WZ	.89203278 00	PX	-.23648495 00	PY	.93409173 00	PZ	-.26748364 00
QX	-.92227216 00	QY	-.12916664 00	QZ	.36432130 00	RX	.57516250-01	RY	-.78216498-01	RZ	-.99527586 00
BX	.74756967 00	BY	.49627442 00	BZ	-.44141996 00	TX	.80563077 00	TY	.59241799 00	TZ	.00000000 00
SXI	-.58961932 00	SYI	.80182485 00	SZI	-.97087278-01	DAI	-.55714680 01	RAI	.12632878 03		
SXO	-.15714355 00	SYO	-.90641095 00	SZO	.39207789 00	DAO	.23083853 02	RAO	.26016445 03		
ETE	.34498536 03	ETS	.14469855 03	ETC	.23295823 03						
BTI	.16239669 04	BRT	.80361553 03	B	.18119234 04	THA	.26328379 02				

J MATRIX ITERATION NUMBER 2

	X	Y	Z	DX	DY	DZ	KE	RE	G
X	.16970309 05	.39899749 04	.63881525 03	.18980165 10	-.16279886 09	-.65764090 07	-.24389978 04	-.40540256 06	.47755162 04
Y	.39899749 04	.96720529 03	.16312822 03	.43763136 09	-.31426166 08	.97231213 06	-.56712879 03	-.92773499 05	.10792825 04
Z	.63881525 03	.16312822 03	.32966515 02	.69654358 08	-.22005730 07	.11297926 07	-.88601646 02	-.14283404 05	.16039950 03
DX	.18980165 10	.43763136 09	.69654358 08	.22551448 15	-.17491077 14	-.59411370 12	-.28748439 09	-.47282010 11	.58030034 09
DY	-.16279886 09	-.31426166 08	-.22005730 07	-.17491077 14	.48911218 13	.10120460 13	.20432735 08	.47334932 10	-.54095477 08
DZ	-.65764090 07	.97231213 06	.11297926 07	-.59411370 12	.10120460 13	.38278893 12	.16779415 06	.25736805 09	-.68447285 07
KE	-.24389978 04	-.56712879 03	-.88601646 02	-.28748439 09	.20432735 08	.16779415 06	.37477857 03	.59619459 05	-.70956901 03
RE	-.40540256 06	-.92773499 05	-.14283404 05	-.47282010 11	.47334932 10	.25736805 09	.59619459 05	.10440718 08	-.12122856 06
G	.47755162 04	.10792825 04	.16039950 03	.56030034 09	-.54095477 08	-.68447285 07	-.70956901 03	-.12122856 06	.14492996 04
KM	.16795320 05	.37832119 04	.55310068 03	.19738730 10	-.19236794 09	-.17652048 08	-.25150989 04	-.42240601 06	.50511039 04
RI(01)	-.10782327 03	-.39245117 02	-.10622564 02	-.58088388-03	-.13701642-02	.30789632-02	-.71318755 01	-.91926836 00	.59659083 00
LO(01)	-.28437181 05	-.10315742 05	-.30037066 04	-.11522820-01	.11327891 00	-.29554281 00	-.20269867 04	-.24135398 03	.18845183 03
RI(03)	-.14027254 04	-.30939179 03	-.15988280 02	-.64857917 08	.14131137 08	.59194472 07	.18721081 03	.91091532 04	-.21576971 03
LA(03)	-.10386702 06	.22033429 05	.46152305 03	.44390734 10	-.13646346 10	-.51349976 09	-.13724351 05	-.70421673 06	.16498879 05
LO(03)	.37020680 06	.10064388 06	.30577152 05	.54186565 11	.11300400 11	.21674890 10	-.74800795 05	-.42059277 07	.77183721 05
RI(04)	.23783908 03	.10452200 03	.29361665 02	.23955915 08	.11239207 08	.30351139 07	.62116030 01	-.11397275 03	.85629790 01
LA(04)	-.90057119 04	-.19835784 04	-.64445065 03	.15636342 10	.73432201 09	.19808052 09	-.12493157 04	-.76882660 04	.71753717 03
LO(04)	.26193551 05	.85152803 04	.41345714 04	.57039849 10	.25616695 10	.73586065 09	-.25904420 04	-.32671444 05	.24551444 04
RI(05)	.25989436 02	.11686282 02	.10302046 02	.60972927 07	.17755313 07	.20925618 06	-.40858149 02	-.20012375 03	.12256203 02
LO(05)	.19642046 06	.58587658 05	.14257273 05	.64955681 10	.26334563 10	.77967992 09	-.14964518 05	-.10384517 06	.49864408 04

	KM	RI(01)	LO(01)	RI(03)	LA(03)	LO(03)	RI(04)	LA(04)	LO(04)
X	.16795320 05	-.10782327 03	-.28437181 05	-.14027254 04	-.10386702 06	.37020680 06	.23783908 03	-.90057119 04	.26193551 05
Y	.37832119 04	-.39245117 02	-.10315742 05	-.30939179 03	.22033429 05	.10064388 06	.10452200 03	-.19835784 04	.85152803 04
Z	.55310068 03	-.10622564 02	-.30037066 04	-.15988280 02	.46152305 03	.30577152 05	.29361665 02	-.64445065 03	.41345714 04
DX	.19738730 10	.58088388-03	-.11522820-01	-.64857917 08	.44390734 10	.54186565 11	.23955915 08	.15636342 10	.57039849 10
DY	-.19236794 09	-.13701642-02	.11327891 00	.14131137 08	-.13646346 10	.11300400 11	.11239207 08	.73432201 09	.25616695 10
DZ	-.17652048 08	.30789632-02	-.29554281 00	.59194472 07	-.51349976 09	.21674890 10	.30351139 07	.19808052 09	.73586065 09
KE	-.25150989 04	-.71318755 01	-.20269867 04	.18721081 03	-.13724351 05	-.74800795 05	.62116030 01	-.12493157 04	-.25904420 04
RE	-.42240601 06	-.91926836 00	-.24135398 03	.91091532 04	-.70421673 06	-.42059277 07	-.11397275 03	-.76882660 04	-.32671444 05
G	.50511039 04	.59659083 00	.18845183 03	-.21576971 03	.16498879 05	.77183721 05	.85629790 01	.71753717 03	.24551444 04
KM	.17920411 05	.34664852 00	.91178983 02	-.13748997 04	.10586404 06	.31372414 06	.35086030 02	.23785339 04	.10091504 05
RI(01)	.34664852 00	.74304436 02	.16271992 05	.10387106 02	-.76509416 03	-.64090496 03	-.21371102 03	-.43902879 03	-.15809945 05
LO(01)	.91178983 02	.16271992 05	.44584900 07	.11263179 05	-.83060753 06	-.51771580 06	-.44771042 05	.69709881 06	-.35936073 07
RI(03)	-.13748997 04	.10387106 02	.11263179 05	.14345966 05	-.11065666 07	-.93382970 05	.14181401 03	.21901966 05	.28513988 05
LA(03)	.10586404 06	-.76509416 03	-.83060753 06	-.11065666 07	.87287438 08	.41324117 07	-.10453449 05	-.16148046 07	-.21021726 07
LO(03)	.31372414 06	-.64090496 03	-.51771580 06	-.93382970 05	.41324117 07	.17420658 09	-.73938430 04	-.10766111 07	-.14249735 07
RI(04)	.35086030 02	-.21371102 03	-.44771042 05	.14181401 03	-.10453449 05	-.73938430 04	.22936632 04	.10642136 06	.19146267 06
LA(04)	.23785339 04	-.43902879 03	.69709881 06	.21901966 05	-.16148046 07	-.10766111 07	.10642136 06	.88037360 07	.90101978 07
LO(04)	.10091504 05	-.15809945 05	-.35936073 07	.28513988 05	-.21021726 07	-.14249735 07	.19146267 06	.90101978 07	.46874339 08
RI(05)	.38419044 02	-.47263028 02	.12143414 05	-.12203543 02	.90126955 03	.32313102 03	-.20702050 03	-.75700005 04	-.18564167 05
LO(05)	.26743580 05	-.11211580 05	-.34050930 07	.48244372 04	-.35561785 06	-.25206016 06	-.56762017 05	-.61964460 07	-.89941672 07

	RI(05)	LO(05)
X	.25989436 02	.19642046 06
Y	.11686282 02	.58587658 05
Z	.10302046 02	.14257273 05
DX	.60972927 07	.64955681 10
DY	.17755313 07	.26334563 10
DZ	.20925618 06	.77967992 09
KE	-.40858149 02	-.14964518 05
RE	-.20012375 03	-.10384517 06
G	.12256203 02	.49864408 04
KM	.38419044 02	.26743580 05
RI(01)	-.47263028 02	-.11211580 05
LO(01)	.12143414 05	-.34050930 07
RI(03)	-.12203543 02	.48244372 04
LA(03)	.90126955 03	-.35561785 06
LO(03)	.32313102 03	-.25206016 06
RI(04)	-.20702050 03	-.56762017 05
LA(04)	-.75700005 04	-.61964460 07
LO(04)	-.18564167 05	-.89941672 07
RI(05)	.28108323 04	.18952934 05
LO(05)	.18952934 05	.92106505 08

CORRELATIONS BASED ON J MATRIX ITERATION NUMBER 2

	X	Y	Z	DX	DY	DZ	KE	RE	G
X	-.10000000 01	-.98484065 00	-.85407081 00	-.97021483 00	.56506998 00	.81595133-01	.96711732 00	.96311121 00	-.96293365 00
Y	-.98484065 00	-.10000000 01	-.91355193 00	-.93704811 00	.45690703 00	-.50532023-01	.94196551 00	.92320772 00	-.91158403 00
Z	-.85407081 00	-.91355193 00	-.10000000 01	-.80783852 00	.17329858 00	-.31804056 00	.79710935 00	.76989236 00	-.73381639 00
DX	-.97021483 00	-.93704811 00	-.80783852 00	-.10000000 01	.52665365 00	.59101074-01	.98887110 00	.97441407 00	-.98006433 00
DY	.56506998 00	.45690703 00	.17329858 00	.52665365 00	-.10000000 01	-.73963309 00	-.47723787 00	-.66238782 00	.66626119 00
DZ	.81595133-01	-.50532023-01	-.31804056 00	.59101074-01	-.73963309 00	-.10000000 01	-.14009085-01	-.12873889 00	.20568881 00
KE	.96711732 00	.94196551 00	.79710935 00	.98887110 00	-.47723787 00	-.14009085-01	-.10000000 01	-.95309345 00	.96278249 00
RE	.96311121 00	.92320772 00	.76989236 00	.97441407 00	-.66238782 00	-.12873889 00	-.95309345 00	-.10000000 01	.98550917 00
G	-.96293365 00	-.91158403 00	-.73381639 00	-.98006433 00	.66626119 00	.20568881 00	.96278249 00	.98550917 00	-.10000000 01
KM	-.96309569 00	-.90871429 00	-.71960421 00	-.98187909 00	.64976224 00	.21312846 00	.97049595 00	.97654201 00	-.99113595 00
RI(01)	.96019677-01	.14639253 00	.21462754 00	-.44873995-11	.71872208-10	-.57732110-09	.42737489-01	.33004241-04	-.18179842-02
LO(01)	.10338267 00	.15708953 00	.24775766 00	.36339393-12	-.24257774-10	.22622824-09	.49587205-01	.35374913-04	-.23443765-02
RI(03)	.89900661-01	.83058590-01	.23248789-01	.36058768-01	-.53346751-01	-.79879729-01	-.80738123-01	-.23536828-01	.47320192-01
LA(03)	-.85340840-01	-.75831015-01	-.86036155-02	-.31639472-01	.66044438-01	.88835117-01	.75880217-01	.23327343-01	-.46387339-01
LO(03)	-.21531151 00	-.24518607 00	-.40348579 00	-.27338340 00	-.38713044 00	-.26542690 00	.29274303 00	.98619851-01	-.15360818 00
RI(04)	-.38121811-01	-.70175182-01	-.10677740 00	-.33308934-01	-.10611251 00	-.10243078 00	-.66996405-02	.73649704-03	-.46965717-02
LA(04)	.23299128-01	.21495944-01	.37828545-01	-.35092510-01	-.11190482 00	-.10790177 00	.21749602-01	.80191755-03	-.63523117-02
LO(04)	-.29368510-01	-.39991900-01	-.10517836 00	-.55478355-01	-.16918088 00	-.17371940 00	.19544246-01	.14768472-02	-.94195546-02
RI(05)	-.37630025-02	-.70876060-02	-.33843051-01	-.76582997-02	-.15142815-01	-.63794190-02	.39808320-01	.11681967-02	-.60723863-02
LO(05)	-.15710743 00	-.19629157 00	-.25873476 00	-.45069711-01	-.12407275 00	-.13130810 00	.80543447-01	.33486980-02	-.13647919-01

	KM	RI(01)	LO(01)	RI(03)	LA(03)	LO(03)	RI(04)	LA(04)	LO(04)
X	-.96309569 00	.96019677-01	.10338267 00	.89900661-01	-.85340840-01	-.21531151 00	-.38121811-01	.23299128-01	-.29368510-01
Y	-.90871429 00	.14639253 00	.15708953 00	.83058590-01	-.75831015-01	-.24518607 00	-.70175182-01	.21495944-01	-.39991900-01
Z	-.71960421 00	.21462754 00	.24775766 00	.23248789-01	-.86036155-02	-.40348579 00	-.10677740 00	.37828545-01	-.10517836 00
DX	-.98187909 00	-.44873995-11	.36339393-12	.36058768-01	-.31639472-01	-.27338340 00	-.33308934-01	-.35092510-01	-.55478355-01
DY	.64976224 00	.71872208-10	-.24257774-10	-.53346751-01	.66044438-01	-.38713044 00	-.10611251 00	-.11190482 00	-.16918088 00
DZ	.21312846 00	-.57732110-09	.22622824-09	-.79879729-01	.88835117-01	-.26542690 00	-.10243078 00	-.10790177 00	-.17371940 00
KE	.97049595 00	.42737489-01	.49587205-01	-.80738123-01	.7588021?-01	.29274303 00	-.66996405-02	.21749602-01	.19544246-01
RE	.97654201 00	.33004241-04	.35374913-04	-.23536828-01	.23327343-01	.98619851-01	.73649704-03	.80191755-03	.14768472-02
G	-.99113595 00	-.18179842-02	-.23443765-02	.47320192-01	-.46387339-01	-.15360818 00	-.46965717-02	-.63523117-02	-.94195546-02
KM	-.10000000 01	-.30040558-03	-.32257214-03	.85749610-01	-.84644475-01	-.17755859 00	-.54726216-02	-.59882766-02	-.11010685-01
RI(01)	-.30040558-03	-.10000000 01	-.89400398 00	-.10060563-01	.95001755-02	.56331845-02	.51767205 00	.17165329-01	.26788932 00
LO(01)	-.32257214-03	-.89400398 00	-.10000000 01	-.44535077-01	.42104264-01	.18576558-01	.44272952 00	-.11126714 00	.24858169 00
RI(03)	.85749610-01	-.10060563-01	-.44535077-01	-.10000000 01	.98886452 00	.59070481-01	-.24722330-01	-.61628940-01	-.34771666-01
LA(03)	-.84644475-01	.95001755-02	.42104264-01	.98886452 00	-.99999999 00	-.33511620-01	.23362478-01	.58251967-01	.32864340-01
LO(03)	-.17755859 00	.56331845-02	.18576558-01	.59070481-01	-.33511620-01	-.10000000 01	.11696963-01	.27491160-01	.15769101-01
RI(04)	-.54726216-02	.51767205 00	.44272952 00	-.24722330-01	.23362478-01	.11696963-01	-.10000000 01	-.74891148 00	-.58391778 00
LA(04)	-.59882766-02	.17165329-01	-.11126714 00	-.61628940-01	.58251967-01	.27491160-01	-.74891148 00	-.10000000 01	-.44354047 00
LO(04)	-.11010685-01	.26788932 00	.24858169 00	-.34771666-01	.32864340-01	.15769101-01	-.58391778 00	-.44354047 00	-.10000000 01
RI(05)	-.54132127-02	.10341813 00	-.10847494 00	.19217796-02	-.18195389-02	-.46177339-03	.81532554-01	.48122140-01	.51143496-01
LO(05)	-.20816150-01	.13552341 00	.16803120 00	-.41969772-02	.39660896-02	.19898795-02	.12349456 00	.21760257 00	.13688260 00

	RI(05)	LO(05)
X	-.37630025-02	-.15710743 00
Y	-.70876060-02	-.19629157 00
Z	.33843051-01	-.25873476 00
DX	-.76582997-02	-.45069711-01
DY	-.15142815-01	-.12407275 00
DZ	-.63794190-02	-.13130810 00
KE	.39808320-01	.80543447-01
RE	.11681967-02	.33486980-02
G	-.60723863-02	-.13647919-01
KM	-.54132127-02	-.20816150-01
RI(01)	.10341813 00	.13552341 00
LO(01)	-.10847494 00	.16803120 00
RI(03)	.19217796-02	-.41969772-02
LA(03)	-.18195389-02	.39660896-02
LO(03)	-.46177339-03	.19898795-02
RI(04)	.81532554-01	.12349456 00
LA(04)	.48122140-01	.21760257 00
LO(04)	.51143496-01	.13688260 00
RI(05)	-.10000000 01	-.37248932-01
LO(05)	-.37248932-01	-.10000000 01

RA7 POST M/C WITH PRE DATA AS APRIORI 14 NOV

ITERATION NUMBER 2 EPOCH 64/07/29 102758.000 CLOCK 133950 SOS .30758 02 QSOS .31895 02

	Q	DQ	STDEVDQ	OLD Q	NEW Q	NOMINAL Q	DQ (NOM)
	X	.75017260-03	.55427790 00	.15667452 06	.15667452 06	.15667409 06	.43554688 00
	Y	-.25883802-02	.18909260 01	.63041633 05	.63041633 05	.63043567 05	-.19331055 01
	Z	.20680010-02	.36300793 01	.80776752 04	.80776773 04	.80732194 04	.44579468 01
	DX	.18229003-07	.56184658-05	.14342615 01	.14342616 01	.14343088 01	-.47236681-04
	DY	-.43779750-07	.18094301-04	.97257024 00	.97257020 00	.97265000 00	-.79803168-04
	DZ	.89194340-07	.34768797-04	.28116142 00	.28116151 00	.28112921 00	.32301992-04
	KE	.22880585-02	.15303436 01	.39860138 06	.39860138 06	.39860177 06	-.38671875 00
	RE	.37447305-04	.36229695-01	.63783080 04	.63783080 04	.63783252 04	-.17211914-01
	G	.37170726-04	.29963458 00	.39220320 00	.39224036 00	.40007859 00	-.78382231-02
	KM	.13894891-03	.16708637 00	.49025898 04	.49025900 04	.49027693 04	-.17932129 00
STA	1						
	RI	.29484530-03	.32011900 00	.63756446 04	.63756449 04	.63756695 04	-.24658203-01
	LO	-.12804053-05	.14856316-02	.27705179 02	.27705178 02	.27704883 02	.29516220-03
STA	3						
	RI	-.16486319-04	.58125911-01	.63718803 04	.63718802 04	.63718724 04	.79345703-02
	LA	.70306135-06	.73879626-03	.35117429 02	.35117430 02	.35117447 02	-.16689301-04
	LO	.94682192-07	.62417711-03	.24319448 03	.24319448 03	.24319473 03	-.24986267-03
STA	4						
	RI	.71533650-04	.57739323-01	.63726015 04	.63726016 04	.63725922 04	.94604492-02
	LA	.51639850-06	.77359572-03	-.31212265 02	-.31212264 02	-.31212461 02	.19693374-03
	LO	.13713281-05	.64313553-03	.13688756 03	.13688756 03	.13688810 03	-.54359436-03
STA	5						
	RI	.43197887-04	.25404297-01	.63754784 04	.63754784 04	.63754627 04	.15625000-01
	LO	-.40899602-06	.61865272-03	.27685339 02	.27685339 02	.27685950 02	-.61058997-03

COVARIANCE MATRIX OF ESTIMATED PARAMETERS ITERATION NUMBER 2

	X	Y	Z	DX	DY	DZ	KE	RE	G
X	.30722399 00	-.98625403 00	.11672552 01	.19744463-05	-.57214722-05	.12780917-04	-.11636031 00	.13981280-01	-.78391934-02
Y	-.98625403 00	.35756012 01	-.55103058 01	-.65204328-05	.22985862-04	-.45855048-04	.12319744 01	-.52346163-01	.10114864-01
Z	.11672552 01	-.55103058 01	.13177476 02	.11420648-04	-.51615141-04	.91980971-04	-.37734081 01	.10493568 00	.57594169-01
DX	.19744463-05	-.65204328-05	.11420648-04	.31567158-10	-.92704246-10	.18275381-09	-.62754984-06	.19005509-06	-.18949724-06
DY	-.57214722-05	.22985862-04	-.51615141-04	-.92784246-10	.32740374-09	-.61510009-09	.71929342-05	-.64102732-06	.20023810-06
DZ	.12780917-04	-.45855048-04	.91980971-04	.18275381-09	-.61510009-09	.12088693-08	-.68541985-05	.12394816-05	-.10309564-05
KE	-.11636031 00	.12319744 01	-.37734081 01	.62754984-06	.71929342-05	-.68541985-05	.23419515 01	-.11571507-01	.65541669-02
RE	.13981280-01	-.52346163-01	.10493568 00	.19005509-06	-.64102732-06	.12394816-05	-.11571507-01	.13125908-02	.97503653-04
G	-.78391934-02	.10114864-01	.57594169-01	-.18949724-06	.20023810-06	-.10309564-06	.65541669-02	.97503653-04	.89780880-01
KM	-.60550599-01	.17218261 00	-.91421402-01	.44096627-06	.88392027-06	-.18678364-05	.14079141-01	-.21764139-02	.44107735-02
RI(01)	.14225842-01	-.16869669-01	.61889157-01	.23250200-07	.86525856-07	.19188069-06	.56797750-01	.21174448-04	-.48810453-03
LO(01)	-.14434376-03	.58302046-03	-.55470012-03	.50383222-09	-.28979728-09	.70968278-09	.59853821-03	.58737314-07	.20788301-04
RI(03)	.20770221-02	-.10864308-01	.33256309-01	.23196464-07	-.11482861-06	.18891136-06	-.95434430-02	.23769043-03	.32240217-04
LA(03)	-.36599490-04	.11747604-03	-.91261365-04	-.18035798-09	.67710610-09	-.17036768-08	.15352399-04	-.15065486-05	-.28481701-07
LO(03)	-.29081140-03	.10694123-02	-.19003905-02	-.27790469-08	.91426244-08	-.17932386-07	.31610765-03	-.20252136-04	.29594182-05
RI(04)	.45239137-02	-.22477663-01	.48123525-01	.20256476-07	-.14712887-06	.12172276-06	.25413338-06	-.19856429-01	.23633580-08
LA(04)	.43169525-04	-.16898449-03	.32917632-03	.25005474-09	-.12172276-08	.23633580-08	-.78497351-04	.25873037-05	.17611564-05
LO(04)	-.30859734-03	.10622654-02	-.18787549-02	-.29922799-08	.92502493-08	-.18889607-07	.15714878-03	-.20542879-04	.43867034-05
RI(05)	.54864675-02	-.16414988-01	.21944612-01	.56449349-07	-.15795213-06	.35499457-06	.57131375-02	.35859197-03	.81466942-04
LO(05)	-.30771112-03	.10769768-02	-.17555282-02	-.27592701-08	.89341856-08	-.18021194-07	.24682402-03	-.19899743-04	.44741727-05

	KM	RI(01)	LO(01)	RI(03)	LA(03)	LO(03)	RI(04)	LA(04)	LO(04)
X	-.60550599-01	.14225842-01	-.14434376-03	.20770221-02	-.36599490-04	-.29081140-03	.45239137-02	.43169525-04	-.30859734-03
Y	.17218261 00	-.16869669-01	.58302046-03	-.10864308-01	.11747604-03	.10694123-02	-.22477663-01	-.16898449-03	.10622654-02
Z	-.91421402-01	.61889157-01	-.55470012-03	.33256309-01	-.91261365-04	.19003905-02	.48123525-01	.32917632-03	-.18787549-02
DX	-.44096627-06	.23250200-07	.50383222-09	.23196464-07	-.18035798-09	-.27790469-08	.20256476-07	.25005474-09	-.29922799-08
DY	.88392027-06	.86525856-07	-.28979728-09	-.11482861-06	.67710610-09	.91426244-08	-.14712887-06	-.12172276-08	.92502493-08
DZ	-.18678364-05	.19188069-06	.70968278-09	.18891136-06	-.17036768-08	-.17932386-07	.25413338-06	.23633580-08	-.18889607-07
KE	.14079141-01	.56797750-01	.59853821-03	-.95434430-02	.15352399-04	.31610765-03	-.19856429-01	-.78497351-04	.15714878-03
RE	-.21739139-02	.21174448-04	.58737314-07	.23769043-03	-.15065486-05	-.20252136-04	.23869519-03	.25873037-05	-.20542879-04
G	.44107735-02	-.48810453-03	.20788301-04	.32240217-04	-.28481701-07	.29594182-05	.98582038-04	.17611564-05	.43867034-05
KM	.27917855-01	-.67555274-03	.49062726-04	.61432014-04	.46260878-05	.50147331-04	-.42503281-03	-.27749806-05	.55929868-04
RI(01)	-.67555274-03	.10247617 00	-.33324110-03	.32298386-03	.88468032-06	.11258772-05	.29005305-02	.42267872-05	-.10025192-04
LO(01)	.49062726-04	-.33324110-03	.22071013-05	-.15228585-05	.23397614-07	.84022531-07	.17008968-04	-.47293767-06	.86429536-07
RI(03)	.61432014-04	.32298386-03	-.15228585-05	.33786216-02	.61483197-04	-.37802681-05	.11476978-03	.47930495-06	-.36766256-05
LA(03)	.46260878-05	.88468032-06	.23397614-07	.54581991-06	.33270169-07	-.62401485-06	-.73072263-08	.30198977-07		
LO(03)	.50147331-04	.11258772-05	.84022531-07	-.37802681-05	.33270169-07	.38959708-06	-.58318610-05	-.46311178-07	.37217489-06	
RI(04)	-.42503281-03	.29005305-02	.17008968-04	.11476978-03	-.62401485-06	-.58318610-05	.33338294-02	-.34490378-04	.78193808-05	
LA(04)	-.27749806-05	.42267872-05	-.47293767-06	.47930495-06	-.73072263-08	-.46311178-07	-.34490378-04	.59845036-06	-.45458953-07	
LO(04)	.55929868-04	-.10025192-04	.86429536-07	-.36766256-05	.30198977-07	.37217489-06	-.78193808-05	-.45458953-07	.41362332-06	
RI(05)	-.56802807-03	.37927577-02	-.11444848-04	.61042573-04	-.46679594-06	.56846392-05	.10708535-03	.18695865-05	-.67077247-05	
LO(05)	.53893163-04	-.57702871-05	.10240330-06	-.42332243-05	.28417624-07	.36971597-06	-.50471583-05	-.50459689-07	.37179442-06	

	RI(05)	LO(05)
X	.54864675-02	-.30771112-03
Y	-.16414988-01	.10769768-02
Z	.21944612-01	-.17555282-02
DX	.56449349-07	-.27592701-08
DY	-.15795213-06	.89341856-08
DZ	.35499457-06	-.18021194-07
KE	.57131375-02	.24682402-03
RE	.35859197-03	-.19899743-04
G	.81466942-04	.44741727-05
KM	-.56802807-03	.53893163-04
RI(01)	.37927577-02	-.57702871-05
LO(01)	-.11444848-04	.10240330-06
RI(03)	.61042573-04	-.42332243-05
LA(03)	-.46679594-06	.28417624-07
LO(03)	-.56846392-05	.36971597-06
RI(04)	.10708535-03	-.50471583-05
LA(04)	.18695865-05	-.50459689-07
LO(04)	-.67077247-05	.37179442-06
RI(05)	.64533832-03	-.62104760-05
LO(05)	-.62104760-05	.38273119-06

CORRELATION MATRIX OF ESTIMATED PARAMETERS ITERATION NUMBER 2

	X	Y	Z	DX	DY	DZ	KE	RE	G
X	.10000000 01	-.94099364 00	.58012573 00	.63401570 00	-.57047736 00	.66320040 00	-.13717923 00	.69623315 00	-.47201074-01
Y	-.94099364 00	.10000000 01	-.80275875 00	-.61373960 00	.67180686 00	-.71269128 00	.42573388 00	-.76409198 00	.17852275-01
Z	.58012573 00	-.80275875 00	.99999999 00	.55995983 00	-.78581297 00	.72877289 00	-.67924853 00	.79788888 00	.52950549-01
DX	.63401570 00	-.61373960 00	.55995983 00	.99999999 00	-.91267190 00	.93553284 00	.72986331-01	.93367792 00	-.11356236 00
DY	-.57047736 00	.67180686 00	-.78581297 00	-.91267190 00	.10000000 01	-.97771956 00	.25976182 00	-.97784505 00	.36932863-01
DZ	.66320040 00	-.71269128 00	.72877289 00	.93553284 00	-.97771956 00	.10000000 01	-.12881845 00	.98397877 00	.98959775-02
KE	-.13717923 00	.42573388 00	-.67924853 00	.72986331-01	.25976182 00	-.12881845 00	.10000000 01	-.20870665 00	.14293435-01
RE	.69623315 00	-.76409198 00	.79788888 00	.93367792 00	-.97784505 00	.98397877 00	-.20870665 00	.10000000 01	.89818185-02
G	-.47201074-01	.17852275-01	.52950549-01	-.11356236 00	.36932863-01	.98959775-02	.14293435-01	.89818185-02	.99999999 00
KM	-.65380745 00	.56497162 00	-.15072689 00	-.46972604 00	.29236828 00	-.32152011 00	.35061264-01	-.35955095 00	.88101195-01
RI(01)	.80174998-01	-.28034150-01	.53258262-01	.12926993-01	.14938006-01	.17239717-01	.11593931 00	.18257276-02	-.50887305-02
LO(01)	.17529088 00	-.20753824 00	-.10285633 00	.60361088-01	-.10780561-01	.13739264-01	.26326419 00	.10912852-02	.48699897-01
RI(03)	.64467937-01	-.98845690-01	.15761159 00	.71028765-01	-.10917885 00	.93475676-01	-.10728682 00	.11286967 00	.18511271-02
LA(03)	-.89376383-01	.84091110-01	-.34028763-01	-.45377608-01	.50851255-01	-.80250535-01	.13570838-01	-.56205144-01	-.12986173-03
LO(03)	-.84057415 00	.90607215 00	-.83872364 00	-.79244712 00	.80950813 00	-.82630535 00	.33093158 00	-.89556748 00	.15823646-01
RI(04)	.14133752 00	-.20587562 00	.22959881 00	.62441663-01	-.14082650 00	.12659926 00	-.22471937 00	.13800766 00	.56981938-02
LA(04)	.10067825 00	-.11552028 00	.11721911 00	.57531180-01	-.86959272-01	.87866995-01	-.66305871-01	.92314234-01	.75978710-02
LO(04)	-.86568942 00	.87348605 00	-.71908587 00	-.82809862 00	.79489380 00	-.84475497 00	.15966862 00	-.88164577 00	.22763751-01
RI(05)	.38963509 00	-.34171091 00	.23796035 00	.39548864 00	-.34361845 00	.40190634 00	-.14695303 00	.38960875 00	.10702427-01
LO(05)	-.89736412 00	.92062945 00	-.78170840 00	-.79383371 00	.79811636 00	-.83781271 00	.26070631 00	-.88784236 00	.24136476-01

	KM	RI(01)	LO(01)	RI(03)	LA(03)	LO(03)	RI(04)	LA(04)	LO(04)
X	-.65380745 00	.80174998-01	.17529088 00	.64467937-01	-.89376383-01	-.84057415 00	.14133752 00	.10067825 00	-.86568942 00
Y	.56497162 00	-.28034150-01	.20753824 00	-.98845690-01	.84091110-01	.90607215 00	-.20587562 00	-.11552028 00	.87348605 00
Z	-.15072689 00	.53258262-01	-.10285633 00	.15761159 00	-.34028763-01	-.83872364 00	.22959881 00	.11721911 00	-.71908587 00
DX	-.46972604 00	.12926993-01	.60361088-01	.71028765-01	-.45377608-01	-.79244712 00	.62441663-01	.57531180-01	-.82809862 00
DY	.29236828 00	-.14938006-01	-.10780561-01	-.10917885 00	.50851255-01	.80950813 00	-.14082650 00	-.86959272-01	.79489380 00
DZ	-.32152011 00	.17239717-01	.13739264-01	-.93475676-01	-.80250535-01	-.82630535 00	.12659926 00	.87866995-01	-.84475497 00
KE	.35061264-01	.11593931 00	.26326419 00	-.10728682 00	.13570838-01	.33093158 00	-.22471937 00	-.66305871-01	.15966862 00
RE	-.35955095 00	.18257276-02	.10912852-02	.11286967 00	-.56205144-01	-.89556748 00	.13800766 00	.92314234-01	-.88164577 00
G	.88101195-01	-.50887305-02	.48699897-01	.18511271-02	-.12986173-03	.15823646-01	.56981938-02	.75978710-02	.22763751-01
KM	.10000000 01	-.12630100-01	.19765124 00	.63253411-02	.37475562-01	.48083819 00	-.44036474-01	-.21468657-01	.52047546 00
RI(01)	-.12630100-01	.10000000 01	-.70070621 00	.17357996-01	.37406771-02	.21317474-01	.19028741 00	-.41156061 00	-.48694368-01
LO(01)	.19765124 00	-.70070621 00	.10000000 01	-.17635129-01	.21317474-01	.96600141 00	-.10419454 00	.34196848-01	-.98350649-01
RI(03)	.63253411-02	.17357996-01	-.17635129-01	.10000000 01	.96600141 00	.99999999 00	.72147698-01	-.14647212-01	.63557240-01
LA(03)	.37475562-01	.37406771-02	.21317474-01	.96600141 00	.99999999 00	.72147698-01	-.14647212-01	-.12785385-01	.63557240-01
LO(03)	.48083819 00	.56347119-02	.96610136-01	-.10419454 00	.72147698-01	.10000000 01	-.16181830 00	-.95910005-01	.92712162 00
RI(04)	-.44036474-01	.19028741 00	.34196848-01	-.14647212-01	-.14647212-01	-.16181830 00	.99999999 00	-.77216872 00	-.21057081 00
LA(04)	-.21468657-01	-.17068087-01	-.41156061 00	.10659285-01	-.12785385-01	-.95910006-01	-.77216872 00	.10000000 01	-.91369838-01
LO(04)	.52047546 00	-.48694368-01	-.98458325-01	-.98350649-01	.63557240-01	.92712162 00	-.21057081 00	-.91369838-01	.10000000 01
RI(05)	.13382017 00	.46637628 00	-.30324364 00	.41338609-01	-.24871111-01	-.35848894 00	.73004761-01	.95131491-01	-.41054951 00
LO(05)	.52136962 00	-.29136612-01	.11141814 00	-.11772117 00	.62175050-01	.95744414 00	-.14129549 00	-.10543470 00	.93444434 00

	RI(05)	LO(05)
X	.38963509 00	-.89736412 00
Y	-.34171091 00	.92062945 00
Z	.23796035 00	-.78170840 00
DX	.39548864 00	-.79383371 00
DY	-.34361845 00	.79811636 00
DZ	.40190634 00	-.83781271 00
KE	-.14695303 00	.26070631 00
RE	.38960875 00	-.88784236 00
G	.10702427-01	.24136476-01
KM	-.13382017 00	.52136962 00
RI(01)	.46637628 00	-.29136612-01
LO(01)	-.30324364 00	.11141814 00
RI(03)	.41338609-01	-.11772117 00
LA(03)	-.24871111-01	.62175050-01
LO(03)	-.35848894 00	.95744414 00
RI(04)	.73004761-01	-.14129549 00
LA(04)	.95131491-01	-.10543470 00
LO(04)	-.41054951 00	.93444434 00
RI(05)	.10000000 01	-.39515800 00
LO(05)	-.39515800 00	.10000000 01

STATION NUMBER 12 64/07/29 ITERATION NUMBER 2 PASS NUMBER 07/291

FREQUENCY 8300.0

TIME	TC	Q	CC3	
104132	60	12	.10956325 06 .850-01	.0029
104232	60	12	.10956714 06 .850-01	.0225
104332	60	12	.10957107 06 .850-01	-.0039
104732	60	12	.10958708 06 .850-01	.0049
104832	60	12	.10959115 06 .850-01	-.0215
104932	60	12	.10959526 06 .850-01	-.0107
105432	60	12	.10961623 06 .850-01	.0049
105532	60	12	.10962051 06 .850-01	.0098
105632	60	12	.10962481 06 .850-01	-.0146
105732	60	12	.10962915 06 .850-01	.0166
105832	60	12	.10963351 06 .850-01	.0029
105932	60	12	.10963790 06 .850-01	-.0215
110032	60	12	.10964232 06 .850-01	.0107
110132	60	12	.10964677 06 .850-01	-.0020
110232	60	12	.10965124 06 .850-01	-.0254
110332	60	12	.10965574 06 .850-01	-.0078
110432	60	12	.10966027 06 .850-01	.0000
110532	60	12	.10966482 06 .850-01	-.0039
110932	60	12	.10968329 06 .850-01	-.0088
111032	60	12	.10968797 06 .850-01	.0078
111132	60	12	.10969268 06 .850-01	.0166
111232	60	12	.10969741 06 .850-01	-.0156
111332	60	12	.10970217 06 .850-01	.0098
111432	60	12	.10970695 06 .850-01	-.0059
111532	60	12	.10971176 06 .850-01	.0039
111632	60	12	.10971659 06 .850-01	.0059
112132	60	12	.10974111 06 .850-01	.0059
112232	60	12	.10974608 06 .850-01	-.0010
112532	60	12	.10976114 06 .850-01	-.0078
112632	60	12	.10976620 06 .850-01	.0107
112732	60	12	.10977129 06 .850-01	-.0088

STATION NUMBER 12 64/07/29 ITERATION NUMBER 2 PASS NUMBER 07/292

FREQUENCY 8300.0

TIME	TC	Q	CC3	
113132	60	12	.10979185 06 .850-01	-.0059
113232	60	12	.10979705 06 .850-01	.0000
113332	60	12	.10980226 06 .850-01	.0020
113432	60	12	.10980750 06 .850-01	.0000
113532	60	12	.10981276 06 .850-01	.0098
113632	60	12	.10981803 06 .850-01	.0000
113732	60	12	.10982333 06 .850-01	-.0137
113832	60	12	.10982865 06 .850-01	.0020
113932	60	12	.10983398 06 .850-01	-.0010
114032	60	12	.10983934 06 .850-01	.0098
114132	60	12	.10984471 06 .850-01	.0000
114232	60	12	.10985011 06 .850-01	-.0107
114332	60	12	.10985552 06 .850-01	-.0078
114432	60	12	.10986096 06 .850-01	.0098
114532	60	12	.10986641 06 .850-01	-.0068
114632	60	12	.10987187 06 .850-01	.0068
114732	60	12	.10987736 06 .850-01	.0039
114832	60	12	.10988287 06 .850-01	-.0020
114932	60	12	.10988839 06 .850-01	-.0068
115032	60	12	.10989393 06 .850-01	.0020
115132	60	12	.10989949 06 .850-01	-.0049
115232	60	12	.10990506 06 .850-01	.0049
115332	60	12	.10991065 06 .850-01	-.0039
115432	60	12	.10991626 06 .850-01	.0059
115532	60	12	.10992188 06 .850-01	-.0020
115632	60	12	.10992752 06 .850-01	-.0088
115732	60	12	.10993318 06 .850-01	.0176
115832	60	12	.10993885 06 .850-01	-.0049
115932	60	12	.10994454 06 .850-01	-.0088
120032	60	12	.10995024 06 .850-01	.0049
120332	60	12	.10996744 06 .850-01	.0049
120532	60	12	.10997898 06 .850-01	.0156
120632	60	12	.10998477 06 .850-01	-.0078
120732	60	12	.10999058 06 .850-01	.0039
120932	60	12	.11000223 06 .850-01	.0029
121032	60	12	.11000807 06 .850-01	-.0088
121132	60	12	.11001393 06 .850-01	.0156
121232	60	12	.11001980 06 .850-01	-.0049
121332	60	12	.11002569 06 .850-01	-.0049
121432	60	12	.11003158 06 .850-01	-.0010
121532	60	12	.11003749 06 .850-01	.0078
121632	60	12	.11004341 06 .850-01	.0039
121732	60	12	.11004934 06 .850-01	-.0107
121832	60	12	.11005529 06 .850-01	.0117
121932	60	12	.11006124 06 .850-01	-.0098
122032	60	12	.11006721 06 .850-01	.0078
122132	60	12	.11007318 06 .850-01	-.0020
122232	60	12	.11007917 06 .850-01	.0098
122332	60	12	.11008517 06 .850-01	-.0039
122432	60	12	.11009118 06 .850-01	.0039
122532	60	12	.11009720 06 .850-01	.0029
122632	60	12	.11010322 06 .850-01	-.0088

STATION NUMBER 12 64/07/29 ITERATION NUMBER 2 PASS NUMBER 07/292

FREQUENCY 8300.0

TIME	TC	Q	CC3	
122732	60	12	.11010926 06 .850-01	.0049
122832	60	12	.11011531 06 .850-01	.0068
122932	60	12	.11012136 06 .850-01	.0010
123032	60	12	.11012743 06 .850-01	.0020
123132	60	12	.11013350 06 .850-01	-.0039
123232	60	12	.11013959 06 .850-01	-.0039
123532	60	12	.11015788 06 .850-01	.0166
123632	60	12	.11016400 06 .850-01	.0029
123732	60	12	.11017012 06 .850-01	-.0029
123832	60	12	.11017625 06 .850-01	.0186
124132	60	12	.11019468 06 .850-01	.0059
124232	60	12	.11020083 06 .850-01	-.0166
124332	60	12	.11020699 06 .850-01	-.0049
124432	60	12	.11021316 06 .850-01	-.0137
124532	60	12	.11021934 06 .850-01	.0137
124632	60	12	.11022552 06 .850-01	.0010
124732	60	12	.11023170 06 .850-01	-.0010
124832	60	12	.11023789 06 .850-01	-.0068
124932	60	12	.11024408 06 .850-01	-.0020
125032	60	12	.11025028 06 .850-01	-.0010
125132	60	12	.11025649 06 .850-01	.0127
125232	60	12	.11026269 06 .850-01	-.0127
125332	60	12	.11026891 06 .850-01	.0088
125432	60	12	.11027512 06 .850-01	-.0059
125532	60	12	.11028134 06 .850-01	-.0088
125632	60	12	.11028756 06 .850-01	.0020
125732	60	12	.11029379 06 .850-01	-.0068
125832	60	12	.11030002 06 .850-01	.0146
125932	60	12	.11030625 06 .850-01	.0000
130032	60	12	.11031248 06 .850-01	-.0010
130132	60	12	.11031872 06 .850-01	-.0039
130232	60	12	.11032496 06 .850-01	-.0088
130332	60	12	.11033120 06 .850-01	.0010
130432	60	12	.11033744 06 .850-01	.0088
130532	60	12	.11034368 06 .850-01	.0000
130632	60	12	.11034993 06 .850-01	-.0117
130732	60	12	.11035617 06 .850-01	.0098
130832	60	12	.11036242 06 .850-01	-.0029
130932	60	12	.11036866 06 .850-01	.0000
131032	60	12	.11037491 06 .850-01	.0029
131132	60	12	.11038116 06 .850-01	-.0107
131232	60	12	.11038741 06 .850-01	-.0078
131332	60	12	.11039365 06 .850-01	-.0049
131432	60	12	.11039990 06 .850-01	-.0010
131532	60	12	.11040615 06 .850-01	.0029
131632	60	12	.11041239 06 .850-01	-.0088
131732	60	12	.11041863 06 .850-01	-.0020
131832	60	12	.11042488 06 .850-01	.0059
131932	60	12	.11043112 06 .850-01	-.0010
132032	60	12	.11043736 06 .850-01	.0098
132132	60	12	.11044359 06 .850-01	-.0107
132232	60	12	.11044983 06 .850-01	.0049
132332	60	12	.11045606 06 .850-01	-.0107
132432	60	12	.11046229 06 .850-01	.0098
132532	60	12	.11046852 06 .850-01	.0000
132632	60	12	.11047474 06 .850-01	.0088
132732	60	12	.11048096 06 .850-01	-.0039
132832	60	12	.11048718 06 .850-01	-.0127
133232	60	12	.11051201 06 .850-01	-.0088
133832	60	12	.11054911 06 .850-01	.0029
133932	60	12	.11055528 06 .850-01	-.0117
134032	60	12	.11056144 06 .850-01	-.0059
134132	60	12	.11056759 06 .850-01	.0088
134232	60	12	.11057374 06 .850-01	-.0059
134332	60	12	.11057988 06 .850-01	.0049
134432	60	12	.11058601 06 .850-01	-.0117
134532	60	12	.11059214 06 .850-01	.0117
134632	60	12	.11059826 06 .850-01	.0098
134732	60	12	.11060437 06 .850-01	-.0020
134832	60	12	.11061047 06 .850-01	-.0068
134932	60	12	.11061657 06 .850-01	-.0020
135032	60	12	.11062265 06 .850-01	.0098
135132	60	12	.11062874 06 .850-01	-.0049
135232	60	12	.11063481 06 .850-01	.0088
135332	60	12	.11064087 06 .850-01	-.0215
135432	60	12	.11064692 06 .850-01	.0078
135532	60	12	.11065297 06 .850-01	.0127
135632	60	12	.11065900 06 .850-01	-.0059
135732	60	12	.11066503 06 .850-01	.0010
135832	60	12	.11067105 06 .850-01	.0010
135932	60	12	.11067705 06 .850-01	-.0049
140032	60	12	.11068305 06 .850-01	-.0020
140132	60	12	.11068904 06 .850-01	.0117
140732	60	12	.11072473 06 .850-01	.0029
140832	60	12	.11073064 06 .850-01	-.0059
141232	60	12	.11075415 06 .850-01	.0127
141332	60	12	.11076000 06 .850-01	-.0010
141432	60	12	.11076584 06 .850-01	-.0029
141532	60	12	.11077166 06 .850-01	.0088
141632	60	12	.11077747 06 .850-01	-.0010
141732	60	12	.11078326 06 .850-01	.0059
141832	60	12	.11078904 06 .850-01	.0068
141932	60	12	.11079481 06 .850-01	-.0107
142032	60	12	.11080056 06 .850-01	.0029
142132	60	12	.11080630 06 .850-01	-.0039
142232	60	12	.11081203 06 .850-01	.0049
142332	60	12	.11081774 06 .850-01	-.0068
142432	60	12	.11082343 06 .850-01	.0146
142532	60	12	.11082911 06 .850-01	.0010
142632	60	12	.11083478 06 .850-01	.0020
142732	60	12	.11084043 06 .850-01	.0020
142832	60	12	.11084606 06 .850-01	.0010
142932	60	12	.11085168 06 .850-01	-.0020
143032	60	12	.11085729 06 .850-01	.0117

STATION NUMBER 12 64/07/29 ITERATION NUMBER 2 PASS NUMBER 07/292

FREQUENCY 8300.0

TIME	TC	Q	CC3	
143132	60	12	.11086287 06 .850-01	.0078
143232	60	12	.11086845 06 .850-01	.0039
143332	60	12	.11087400 06 .850-01	.0010
143432	60	12	.11087954 06 .850-01	-.0039
143532	60	12	.11088506 06 .850-01	.0088
143632	60	12	.11089056 06 .850-01	.0059
143732	60	12	.11089605 06 .850-01	.0029
143832	60	12	.11090152 06 .850-01	.0000
144232	60	12	.11092321 06 .850-01	.0020
144332	60	12	.11092859 06 .850-01	.0068
144432	60	12	.11093395 06 .850-01	-.0039
144532	60	12	.11093929 06 .850-01	.0049
144632	60	12	.11094462 06 .850-01	-.0020
144732	60	12	.11094992 06 .850-01	.0107
144832	60	12	.11095521 06 .850-01	-.0078
144932	60	12	.11096047 06 .850-01	.0098
145032	60	12	.11096572 06 .850-01	-.0029
145132	60	12	.11097094 06 .850-01	.0049
145232	60	12	.11097615 06 .850-01	-.0010
145332	60	12	.11098133 06 .850-01	.0137
145432	60	12	.11098650 06 .850-01	.0146
145532	60	12	.11099165 06 .850-01	-.0137
145632	60	12	.11099677 06 .850-01	.0117
145732	60	12	.11100187 06 .850-01	.0078
145832	60	12	.11100696 06 .850-01	.0088
145932	60	12	.11101202 06 .850-01	-.0029
150032	60	12	.11101706 06 .850-01	.0068
150132	60	12	.11102208 06 .850-01	.0049
150232	60	12	.11102707 06 .850-01	-.0088
150332	60	12	.11103205 06 .850-01	.0156
150432	60	12	.11103700 06 .850-01	-.0029
150532	60	12	.11104193 06 .850-01	.0156
150632	60	12	.11104684 06 .850-01	-.0098
150732	60	12	.11105173 06 .850-01	.0039
150832	60	12	.11105659 06 .850-01	.0078
150932	60	12	.11106143 06 .850-01	.0000
151032	60	12	.11106625 06 .850-01	.0166
151132	60	12	.11107104 06 .850-01	.0059
151232	60	12	.11107581 06 .850-01	.0010
151332	60	12	.11108056 06 .850-01	.0039
151432	60	12	.11108529 06 .850-01	-.0029
151532	60	12	.11108999 06 .850-01	.0146
151632	60	12	.11109466 06 .850-01	.0049
151732	60	12	.11109931 06 .850-01	.0039
151832	60	12	.11110394 06 .850-01	-.0078
151932	60	12	.11110854 06 .850-01	.0068
152032	60	12	.11111312 06 .850-01	.0117
152132	60	12	.11111767 06 .850-01	-.0078
152232	60	12	.11112220 06 .850-01	.0137
152332	60	12	.11112670 06 .850-01	-.0059
152432	60	12	.11113118 06 .850-01	.0000
152532	60	12	.11113563 06 .850-01	-.0020
152632	60	12	.11114006 06 .850-01	.0215
152732	60	12	.11114446 06 .850-01	-.0469
152832	60	12	.11114884 06 .850-01	-.0049
152932	60	12	.11115319 06 .850-01	.0127
153032	60	12	.11115751 06 .850-01	-.0098
153332	60	12	.11117032 06 .850-01	-.0020
153432	60	12	.11117453 06 .850-01	-.0020
153532	60	12	.11117872 06 .850-01	.0078
153632	60	12	.11118289 06 .850-01	.0127
153732	60	12	.11118702 06 .850-01	-.0049
153832	60	12	.11119113 06 .850-01	.0039
153932	60	12	.11119521 06 .850-01	.0078
154032	60	12	.11119926 06 .850-01	.0059
154132	60	12	.11120328 06 .850-01	-.0010
154232	60	12	.11120728 06 .850-01	.0029
154332	60	12	.11121125 06 .850-01	.0020
154432	60	12	.11121519 06 .850-01	.0107
154532	60	12	.11121910 06 .850-01	.0000
154632	60	12	.11122298 06 .850-01	.0176
154732	60	12	.11122684 06 .850-01	-.0029
154832	60	12	.11123066 06 .850-01	.0049
154932	60	12	.11123446 06 .850-01	-.0078
155032	60	12	.11123822 06 .850-01	.0088
155132	60	12	.11124196 06 .850-01	-.0117
155232	60	12	.11124567 06 .850-01	.0137
155332	60	12	.11124935 06 .850-01	.0020
155432	60	12	.11125299 06 .850-01	.0039
155532	60	12	.11125661 06 .850-01	.0010
155632	60	12	.11126020 06 .850-01	.0117
155732	60	12	.11126376 06 .850-01	.0039
155832	60	12	.11126729 06 .850-01	.0088
155932	60	12	.11127079 06 .850-01	-.0059
160032	60	12	.11127426 06 .850-01	.0098
160132	60	12	.11127769 06 .850-01	.0049
160232	60	12	.11128110 06 .850-01	-.0010
160332	60	12	.11128448 06 .850-01	.0068
160432	60	12	.11128782 06 .850-01	-.0029
160532	60	12	.11129113 06 .850-01	.0000
160632	60	12	.11129441 06 .850-01	.0020
160732	60	12	.11129766 06 .850-01	.0010
160832	60	12	.11130088 06 .850-01	.0156
160932	60	12	.11130407 06 .850-01	-.0039
161032	60	12	.11130722 06 .850-01	.0068
161132	60	12	.11131035 06 .850-01	.0010
161232	60	12	.11131344 06 .850-01	.0088
161332	60	12	.11131650 06 .850-01	.0010
161432	60	12	.11131953 06 .850-01	-.0098
161532	60	12	.11132252 06 .850-01	.0127
161632	60	12	.11132548 06 .850-01	.0176
161732	60	12	.11132841 06 .850-01	-.0117
161832	60	12	.11133131 06 .850-01	.0078
161932	60	12	.11133417 06 .850-01	.0107

STATION NUMBER 12 64/07/29 ITERATION NUMBER 2 PASS NUMBER 07/292

FREQUENCY 8300.0

TIME	TC	Q	CC3	
162032	60	12	.11133700 06 .850-01	-.0020
162132	60	12	.11133980 06 .850-01	.0000
162232	60	12	.11134256 06 .850-01	.0195
162332	60	12	.11134529 06 .850-01	.0059
162432	60	12	.11134799 06 .850-01	-.0088
162532	60	12	.11135065 06 .850-01	-.0059
162632	60	12	.11135328 06 .850-01	.0146
162732	60	12	.11135588 06 .850-01	.0010
162832	60	12	.11135844 06 .850-01	.0059
162932	60	12	.11136097 06 .850-01	-.0059
163032	60	12	.11136346 06 .850-01	.0166
163132	60	12	.11136592 06 .850-01	.0068
163232	60	12	.11136835 06 .850-01	-.0020
163332	60	12	.11137074 06 .850-01	.0078
163432	60	12	.11137310 06 .850-01	-.0156
163532	60	12	.11137542 06 .850-01	.0127
163632	60	12	.11137771 06 .850-01	.0088
163732	60	12	.11137996 06 .850-01	.0068
163832	60	12	.11138218 06 .850-01	-.0107
163932	60	12	.11138436 06 .850-01	.0078
164032	60	12	.11138650 06 .850-01	-.0049
164132	60	12	.11138861 06 .850-01	.0000
164232	60	12	.11139069 06 .850-01	.0068
164332	60	12	.11139273 06 .850-01	-.0010
164432	60	12	.11139474 06 .850-01	.0117
164532	60	12	.11139671 06 .850-01	.0088
164632	60	12	.11139864 06 .850-01	-.0078
164732	60	12	.11140054 06 .850-01	.0117
164832	60	12	.11140240 06 .850-01	-.0010
164932	60	12	.11140423 06 .850-01	.0068
165032	60	12	.11140601 06 .850-01	.0020
165132	60	12	.11140777 06 .850-01	-.0020
165232	60	12	.11140949 06 .850-01	-.0029
165332	60	12	.11141116 06 .850-01	.0176
165432	60	12	.11141281 06 .850-01	-.0088
165532	60	12	.11141441 06 .850-01	.0000
165632	60	12	.11141599 06 .850-01	-.0039
165732	60	12	.11141752 06 .850-01	-.0029
165832	60	12	.11141902 06 .850-01	.0166
165932	60	12	.11142048 06 .850-01	-.0107
170032	60	12	.11142190 06 .850-01	.0166
170132	60	12	.11142328 06 .850-01	-.0020
170232	60	12	.11142463 06 .850-01	.0000
170332	60	12	.11142594 06 .850-01	-.0117
170432	60	12	.11142722 06 .850-01	.0146
170532	60	12	.11142845 06 .850-01	-.0049
170632	60	12	.11142965 06 .850-01	-.0029
170732	60	12	.11143081 06 .850-01	.0029
171132	60	12	.11143508 06 .850-01	.0039
171232	60	12	.11143605 06 .850-01	-.0010
171332	60	12	.11143698 06 .850-01	-.0020
171432	60	12	.11143788 06 .850-01	.0029
171532	60	12	.11143874 06 .850-01	-.0049
171632	60	12	.11143955 06 .850-01	.0107
171732	60	12	.11144034 06 .850-01	-.0029
171832	60	12	.11144108 06 .850-01	.0049
171932	60	12	.11144178 06 .850-01	.0020
172032	60	12	.11144245 06 .850-01	.0029
172132	60	12	.11144307 06 .850-01	-.0068
172232	60	12	.11144366 06 .850-01	-.0107
172332	60	12	.11144421 06 .852-01	-.0098
172832	60	12	.11144637 06 .852-01	-.0176
172932	60	12	.11144668 06 .852-01	.0010
173032	60	12	.11144696 06 .852-01	-.0078
173132	60	12	.11144719 06 .852-01	.0068
173232	60	12	.11144739 06 .852-01	-.0068
173332	60	12	.11144755 06 .852-01	.0029
173732	60	12	.11144778 06 .854-01	-.0137
173832	60	12	.11144774 06 .854-01	-.0068
173932	60	12	.11144766 06 .854-01	.0068
174032	60	12	.11144754 06 .854-01	-.0049
174132	60	12	.11144738 06 .854-01	-.0127
174232	60	12	.11144718 06 .854-01	.0039
174332	60	12	.11144694 06 .854-01	-.0059
174432	60	12	.11144666 06 .854-01	-.0088
174532	60	12	.11144634 06 .857-01	-.0049
174632	60	12	.11144598 06 .857-01	.0039
174732	60	12	.11144558 06 .857-01	.0049
174832	60	12	.11144514 06 .857-01	-.0215
174932	60	12	.11144466 06 .857-01	-.0068
175032	60	12	.11144413 06 .857-01	-.0029

STATION NUMBER 12 64/07/29 ITERATION NUMBER 2 PASS NUMBER 07/293

FREQUENCY 8300.0

TIME	TC	Q	CC3	
175132	60	12	.11144357 06 .859-01	-.0078
175232	60	12	.11144297 06 .859-01	-.0234
175332	60	12	.11144233 06 .859-01	.0020
175432	60	12	.11144165 06 .859-01	.0010
175532	60	12	.11144092 06 .862-01	-.0088
175632	60	12	.11144016 06 .862-01	-.0127
175732	60	12	.11143936 06 .862-01	-.0088
175832	60	12	.11143851 06 .864-01	.0029
175932	60	12	.11143763 06 .864-01	-.0117
180032	60	12	.11143668 06 .869-01	.0020
180432	60	12	.11143259 06 .872-01	-.0088
180532	60	12	.11143146 06 .872-01	-.0127
180632	60	12	.11143029 06 .874-01	-.0078
180732	60	12	.11142908 06 .876-01	.0029
180832	60	12	.11142783 06 .879-01	-.0107
180932	60	12	.11142653 06 .879-01	-.0010
181032	60	12	.11142520 06 .881-01	-.0176
181432	60	12	.11141945 06 .894-01	-.0215
181532	60	12	.11141791 06 .896-01	.0020
181632	60	12	.11141633 06 .901-01	-.0176
181732	60	12	.11141471 06 .906-01	-.0137
181832	60	12	.11141305 06 .909-01	.0000
181932	60	12	.11141135 06 .913-01	-.0137
182032	60	12	.11140960 06 .920-01	-.0186
182132	60	12	.11140781 06 .925-01	.0010
182232	60	12	.11140599 06 .933-01	-.0225
182332	60	12	.11140412 06 .940-01	-.0039
182432	60	12	.11140221 06 .947-01	-.0117
182532	60	12	.11140026 06 .957-01	-.0283
182632	60	12	.11139827 06 .964-01	-.0186
182732	60	12	.11139624 06 .977-01	-.0195
182832	60	12	.11139416 06 .989-01	-.0117
183232	60	12	.11138545 06 .105 00	-.0205
183332	60	12	.11138317 06 .107 00	-.0244
183432	60	12	.11138085 06 .109 00	-.0195
183532	60	12	.11137849 06 .112 00	-.0244
183632	60	12	.11137609 06 .114 00	-.0205
183732	60	12	.11137364 06 .117 00	-.0098
183832	60	12	.11137116 06 .121 00	-.0254
183932	60	12	.11136863 06 .125 00	-.0322
184032	60	12	.11136606 06 .129 00	-.0146
184132	60	12	.11136346 06 .133 00	-.0244

STATION NUMBER 12 64/07/30 ITERATION NUMBER 2 PASS NUMBER 07/301

FREQUENCY 8200.0

TIME	TC	Q	CC3	
071832	60	12	.10475343 06 .119 00	.0234
071932	60	12	.10475193 06 .116 00	.0049
072032	60	12	.10475048 06 .113 00	.0244
072132	60	12	.10474907 06 .110 00	.0146
072232	60	12	.10474771 06 .108 00	-.0088
072332	60	12	.10474639 06 .106 00	.0234
072432	60	12	.10474512 06 .104 00	-.0068
072532	60	12	.10474390 06 .102 00	.0000
072632	60	12	.10474272 06 .101 00	.0283
072732	60	12	.10474159 06 .994-01	.0098
072832	60	12	.10474050 06 .981-01	-.0039
072932	60	12	.10473946 06 .969-01	.0176
073032	60	12	.10473847 06 .959-01	-.0049
073132	60	12	.10473752 06 .950-01	.0107
073232	60	12	.10473662 06 .942-01	.0127
073332	60	12	.10473576 06 .935-01	.0029
073432	60	12	.10473495 06 .928-01	.0127
073532	60	12	.10473419 06 .920-01	-.0068
073632	60	12	.10473347 06 .916-01	.0117
073732	60	12	.10473280 06 .911-01	.0020
073832	60	12	.10473217 06 .906-01	.0107
073932	60	12	.10473159 06 .901-01	.0088
074032	60	12	.10473106 06 .898-01	.0098
074132	60	12	.10473057 06 .894-01	-.0010
074232	60	12	.10473012 06 .891-01	.0088
074332	60	12	.10472973 06 .889-01	.0049
074432	60	12	.10472938 06 .886-01	.0068
074532	60	12	.10472907 06 .884-01	-.0049
074932	60	12	.10472831 06 .874-01	.0088
075032	60	12	.10472823 06 .872-01	.0010
075132	60	12	.10472820 06 .872-01	.0146
075232	60	12	.10472821 06 .869-01	.0000
075332	60	12	.10472828 06 .869-01	.0068
075432	60	12	.10472838 06 .867-01	.0000
075532	60	12	.10472853 06 .867-01	.0146
075632	60	12	.10472873 06 .864-01	-.0010
075732	60	12	.10472898 06 .864-01	.0059
075832	60	12	.10472926 06 .862-01	-.0156
075932	60	12	.10472960 06 .862-01	.0000
080032	60	12	.10472998 06 .862-01	.0020
080132	60	12	.10473040 06 .859-01	.0107
080232	60	12	.10473088 06 .859-01	.0068
080332	60	12	.10473139 06 .859-01	-.0098
080432	60	12	.10473195 06 .859-01	.0117
080532	60	12	.10473256 06 .857-01	-.0117
080632	60	12	.10473321 06 .857-01	-.0146
080732	60	12	.10473391 06 .857-01	.0049
080832	60	12	.10473465 06 .857-01	.0117
080932	60	12	.10473544 06 .857-01	-.0098
081032	60	12	.10473627 06 .857-01	.0078
081132	60	12	.10473715 06 .854-01	-.0039
081232	60	12	.10473808 06 .854-01	-.0107

STATION NUMBER 12 64/07/30 ITERATION NUMBER 2 PASS NUMBER 07/301

FREQUENCY 8200.0

TIME	TC	Q	CC3	
081332	60	12	.10473904 06 .854-01	.0049
081432	60	12	.10474006 06 .854-01	-.0088
081532	60	12	.10474112 06 .854-01	.0156
081632	60	12	.10474222 06 .854-01	-.0205
081732	60	12	.10474337 06 .854-01	.0146
081832	60	12	.10474456 06 .852-01	-.0107
081932	60	12	.10474580 06 .852-01	.0010
082032	60	12	.10474708 06 .852-01	.0020
082132	60	12	.10474841 06 .852-01	-.0078
082232	60	12	.10474978 06 .852-01	.0039

STATION NUMBER 12 64/07/30 ITERATION NUMBER 2 PASS NUMBER 07/302

FREQUENCY 8200.0

TIME	TC	Q	CC3	
082332	60	12	.10475120 06 .852-01	.0039
082432	60	12	.10475265 06 .852-01	-.0059
082532	60	12	.10475416 06 .852-01	.0049
082632	60	12	.10475571 06 .852-01	-.0107
082732	60	12	.10475730 06 .852-01	-.0039
082832	60	12	.10475894 06 .852-01	.0078
082932	60	12	.10476062 06 .852-01	-.0244
083032	60	12	.10476235 06 .852-01	.0156
083132	60	12	.10476412 06 .852-01	-.0049
083232	60	12	.10476594 06 .852-01	-.0029
083332	60	12	.10476779 06 .850-01	-.0107
083432	60	12	.10476969 06 .850-01	.0195
083532	60	12	.10477164 06 .850-01	-.0264
083632	60	12	.10477363 06 .850-01	.0166
083732	60	12	.10477567 06 .850-01	-.0010
083832	60	12	.10477774 06 .850-01	-.0117
083932	60	12	.10477986 06 .850-01	-.0156
084032	60	12	.10478203 06 .850-01	.0195
084132	60	12	.10478424 06 .850-01	-.0059
084232	60	12	.10478649 06 .850-01	-.0068
084332	60	12	.10478878 06 .850-01	-.0010
084432	60	12	.10479112 06 .850-01	-.0059
084532	60	12	.10479350 06 .850-01	.0127
084632	60	12	.10479593 06 .850-01	-.0117
084732	60	12	.10479839 06 .850-01	.0039
084832	60	12	.10480091 06 .850-01	.0098
084932	60	12	.10480346 06 .850-01	-.0098
085032	60	12	.10480606 06 .850-01	-.0059
085132	60	12	.10480869 06 .850-01	.0049
085232	60	12	.10481137 06 .850-01	.0068
085332	60	12	.10481410 06 .850-01	.0000
085432	60	12	.10481687 06 .850-01	.0000
085532	60	12	.10481967 06 .850-01	-.0098
085632	60	12	.10482253 06 .850-01	.0225
085732	60	12	.10482542 06 .850-01	-.0049
085832	60	12	.10482836 06 .850-01	-.0068
085932	60	12	.10483133 06 .850-01	-.0010
090032	60	12	.10483435 06 .850-01	.0117
090132	60	12	.10483741 06 .850-01	.0000
090232	60	12	.10484052 06 .850-01	-.0039
090332	60	12	.10484366 06 .850-01	.0010
090432	60	12	.10484685 06 .850-01	-.0029
090532	60	12	.10485008 06 .850-01	.0020
090632	60	12	.10485335 06 .850-01	-.0020
090732	60	12	.10485666 06 .850-01	.0029
090832	60	12	.10486002 06 .850-01	.0000
090932	60	12	.10486341 06 .850-01	.0059
091032	60	12	.10486684 06 .850-01	-.0127
091132	60	12	.10487032 06 .850-01	.0107
091232	60	12	.10487384 06 .850-01	-.0059
091332	60	12	.10487740 06 .850-01	.0020
091432	60	12	.10488100 06 .850-01	-.0137

STATION NUMBER 12 64/07/30 ITERATION NUMBER 2 PASS NUMBER 07/302

FREQUENCY 8200.0

TIME	TC	Q	CC3	
091532	60	12	.10488463 06 .850-01	-.0029
091632	60	12	.10488831 06 .850-01	.0176
091732	60	12	.10489203 06 .850-01	-.0195
091832	60	12	.10489580 06 .850-01	.0195
091932	60	12	.10489960 06 .850-01	-.0156
092032	60	12	.10490344 06 .850-01	.0098
092132	60	12	.10490732 06 .850-01	-.0049
092232	60	12	.10491124 06 .850-01	-.0098
092332	60	12	.10491520 06 .850-01	-.0039
092432	60	12	.10491920 06 .850-01	.0117
092532	60	12	.10492324 06 .850-01	-.0127
092632	60	12	.10492732 06 .850-01	.0078
092732	60	12	.10493146 06 .850-01	-.0117
092832	60	12	.10493560 06 .850-01	-.0029
092932	60	12	.10493980 06 .850-01	-.0010
093032	60	12	.10494404 06 .850-01	-.0049
093132	60	12	.10494831 06 .850-01	.0029
093232	60	12	.10495263 06 .850-01	.0039
093332	60	12	.10495698 06 .850-01	.0000
093432	60	12	.10496137 06 .850-01	-.0088
093532	60	12	.10496580 06 .850-01	-.0059
093632	60	12	.10497027 06 .850-01	.0088
093732	60	12	.10497478 06 .850-01	.0010
093832	60	12	.10497933 06 .850-01	.0049
093932	60	12	.10498391 06 .850-01	-.0127
094032	60	12	.10498853 06 .850-01	.0156
094132	60	12	.10499319 06 .850-01	-.0107
094232	60	12	.10499789 06 .850-01	-.0078
094332	60	12	.10500263 06 .850-01	.0068
094432	60	12	.10500740 06 .850-01	-.0156
094532	60	12	.10501221 06 .850-01	-.0088
094632	60	12	.10501705 06 .850-01	.0117
094732	60	12	.10502194 06 .850-01	-.0068
094832	60	12	.10502686 06 .850-01	-.0107
094932	60	12	.10503182 06 .850-01	-.0020
095032	60	12	.10503681 06 .850-01	.0029
095132	60	12	.10504184 06 .850-01	-.0117
095232	60	12	.10504691 06 .850-01	.0039
095332	60	12	.10505202 06 .850-01	.0000
095432	60	12	.10505716 06 .850-01	-.0078
095532	60	12	.10506233 06 .850-01	.0000
095632	60	12	.10506755 06 .850-01	.0039
095732	60	12	.10507279 06 .850-01	-.0107
095832	60	12	.10507808 06 .850-01	.0049
095932	60	12	.10508340 06 .850-01	.0020
100032	60	12	.10508875 06 .850-01	-.0029
100132	60	12	.10509414 06 .850-01	.0059
100232	60	12	.10509957 06 .850-01	-.0195
100332	60	12	.10510503 06 .850-01	.0039
100432	60	12	.10511052 06 .850-01	.0078
100532	60	12	.10511605 06 .850-01	-.0059
100632	60	12	.10512162 06 .850-01	-.0039
100732	60	12	.10512722 06 .850-01	-.0039
100832	60	12	.10513285 06 .850-01	-.0039
100932	60	12	.10513852 06 .850-01	-.0049
101032	60	12	.10514422 06 .850-01	.0088
101132	60	12	.10514996 06 .850-01	.0068
101232	60	12	.10515573 06 .850-01	-.0137
101332	60	12	.10516153 06 .850-01	.0010
101432	60	12	.10516737 06 .850-01	-.0029
101532	60	12	.10517324 06 .850-01	.0107
101632	60	12	.10517914 06 .850-01	-.0107
101732	60	12	.10518508 06 .850-01	.0029
101832	60	12	.10519105 06 .850-01	.0000
101932	60	12	.10519705 06 .850-01	-.0020
102032	60	12	.10520309 06 .850-01	-.0039
102132	60	12	.10520915 06 .850-01	.0127
102232	60	12	.10521525 06 .850-01	-.0215
102332	60	12	.10522138 06 .850-01	.0137
102432	60	12	.10522755 06 .850-01	-.0166
102532	60	12	.10523376 06 .850-01	.0049
102632	60	12	.10523997 06 .850-01	-.0068
102732	60	12	.10524623 06 .850-01	.0000
102832	60	12	.10525252 06 .850-01	-.0059
102932	60	12	.10525884 06 .850-01	.0049
103032	60	12	.10526520 06 .850-01	.0020
103132	60	12	.10527158 06 .850-01	-.0146
103232	60	12	.10527800 06 .850-01	.0039
103332	60	12	.10528444 06 .850-01	-.0088
103432	60	12	.10529092 06 .850-01	-.0010
103532	60	12	.10529742 06 .850-01	.0088
103632	60	12	.10530396 06 .850-01	.0059
103732	60	12	.10531052 06 .850-01	-.0264
103832	60	12	.10531712 06 .850-01	.0098
103932	60	12	.10532375 06 .850-01	.0010
104032	60	12	.10533040 06 .850-01	-.0049
104132	60	12	.10533709 06 .850-01	-.0068
104232	60	12	.10534380 06 .850-01	-.0039
104332	60	12	.10535055 06 .850-01	.0029
104432	60	12	.10535732 06 .850-01	-.0020
104532	60	12	.10536412 06 .850-01	-.0039
104632	60	12	.10537095 06 .850-01	.0000
104732	60	12	.10537781 06 .850-01	-.0068
104832	60	12	.10538469 06 .850-01	.0059
104932	60	12	.10539161 06 .850-01	-.0078
105032	60	12	.10539855 06 .850-01	.0010
105332	60	12	.10541954 06 .850-01	-.0078
105432	60	12	.10542659 06 .850-01	.0068
105532	60	12	.10543367 06 .850-01	-.0059
105632	60	12	.10544078 06 .850-01	-.0107
105732	60	12	.10544791 06 .850-01	.0059
105832	60	12	.10545507 06 .850-01	-.0029
105932	60	12	.10546225 06 .850-01	.0117
110032	60	12	.10546947 06 .850-01	-.0176

STATION NUMBER 12 64/07/30 ITERATION NUMBER 2 PASS NUMBER 07/302

FREQUENCY 8200.0

TIME	TC	Q	CC3	
110132	60	12	.10547670 06 .850-01	.0117
110232	60	12	.10548397 06 .850-01	-.0186
110332	60	12	.10549126 06 .850-01	.0098
110432	60	12	.10549857 06 .850-01	-.0059
110532	60	12	.10550591 06 .850-01	.0039
110632	60	12	.10551328 06 .850-01	.0059
110732	60	12	.10552067 06 .850-01	-.0020
110832	60	12	.10552808 06 .850-01	.0000
110932	60	12	.10553552 06 .850-01	-.0059
111032	60	12	.10554299 06 .850-01	-.0039
111132	60	12	.10555047 06 .850-01	.0078
111232	60	12	.10555799 06 .850-01	-.0049
111332	60	12	.10556552 06 .850-01	-.0068
111432	60	12	.10557308 06 .850-01	-.0010
111532	60	12	.10558067 06 .850-01	-.0020
111632	60	12	.10558827 06 .850-01	.0088
111732	60	12	.10559590 06 .850-01	-.0215
111832	60	12	.10560356 06 .850-01	.0088
111932	60	12	.10561123 06 .850-01	-.0010
112032	60	12	.10561893 06 .850-01	.0166
112132	60	12	.10562665 06 .850-01	-.0205
112232	60	12	.10563440 06 .850-01	.0020
112332	60	12	.10564216 06 .850-01	.0029
112432	60	12	.10564995 06 .850-01	-.0010
112532	60	12	.10565776 06 .850-01	-.0088
112632	60	12	.10566559 06 .850-01	.0107
112732	60	12	.10567344 06 .850-01	-.0088
112832	60	12	.10568131 06 .850-01	.0020
112932	60	12	.10568921 06 .850-01	-.0088
113032	60	12	.10569712 06 .850-01	-.0068
113132	60	12	.10570506 06 .850-01	.0078
113232	60	12	.10571301 06 .850-01	.0020
113332	60	12	.10572099 06 .850-01	-.0078
113432	60	12	.10572899 06 .850-01	.0137
113532	60	12	.10573700 06 .850-01	-.0195
113632	60	12	.10574504 06 .850-01	.0127
113732	60	12	.10575309 06 .850-01	-.0098
113832	60	12	.10576117 06 .850-01	.0156
113932	60	12	.10576926 06 .850-01	-.0098
114032	60	12	.10577737 06 .850-01	-.0059
114132	60	12	.10578550 06 .850-01	-.0029
114232	60	12	.10579365 06 .850-01	-.0029
114332	60	12	.10580182 06 .850-01	-.0029
114432	60	12	.10581000 06 .850-01	.0273
114532	60	12	.10581821 06 .850-01	-.0098
114632	60	12	.10582643 06 .850-01	-.0146
114732	60	12	.10583467 06 .850-01	-.0029
114832	60	12	.10584293 06 .850-01	.0068
114932	60	12	.10585120 06 .850-01	.0010
115032	60	12	.10585949 06 .850-01	-.0068
115132	60	12	.10586780 06 .850-01	.0039
115232	60	12	.10587612 06 .850-01	-.0029
115832	60	12	.10592640 06 .850-01	.0029
115932	60	12	.10593483 06 .850-01	.0029
120032	60	12	.10594328 06 .850-01	.0049
120332	60	12	.10596871 06 .850-01	.0029
120432	60	12	.10597722 06 .850-01	-.0029
120532	60	12	.10598574 06 .850-01	-.0068
120632	60	12	.10599427 06 .850-01	.0098
120732	60	12	.10600282 06 .850-01	-.0215
120832	60	12	.10601138 06 .850-01	.0166
120932	60	12	.10601996 06 .850-01	-.0078
121032	60	12	.10602854 06 .850-01	.0059
121132	60	12	.10603714 06 .850-01	.0059
121232	60	12	.10604576 06 .850-01	-.0059
121332	60	12	.10605438 06 .850-01	.0020
121432	60	12	.10606302 06 .850-01	-.0176
121532	60	12	.10607167 06 .850-01	-.0010
121632	60	12	.10608033 06 .850-01	.0059
121732	60	12	.10608900 06 .850-01	.0010
121832	60	12	.10609768 06 .850-01	.0000
121932	60	12	.10610638 06 .850-01	.0059
122032	60	12	.10611508 06 .850-01	.0000
122132	60	12	.10612380 06 .850-01	.0010
122232	60	12	.10613253 06 .850-01	-.0088
122332	60	12	.10614126 06 .850-01	.0039
122432	60	12	.10615001 06 .850-01	.0078
122532	60	12	.10615877 06 .850-01	.0000
122632	60	12	.10616753 06 .850-01	-.0166
122732	60	12	.10617631 06 .850-01	.0244
122832	60	12	.10618509 06 .850-01	.0059
122932	60	12	.10619389 06 .850-01	-.0059
123032	60	12	.10620269 06 .850-01	.0078
123132	60	12	.10621150 06 .850-01	-.0029
123232	60	12	.10622032 06 .850-01	.0098
123332	60	12	.10622915 06 .850-01	-.0029
123432	60	12	.10623799 06 .850-01	-.0059
123532	60	12	.10624683 06 .850-01	.0000
123632	60	12	.10625568 06 .850-01	-.0186
123732	60	12	.10626454 06 .850-01	.0059
123832	60	12	.10627341 06 .850-01	.0059
123932	60	12	.10628228 06 .850-01	-.0010
124032	60	12	.10629116 06 .850-01	.0020
124132	60	12	.10630005 06 .850-01	-.0010
124232	60	12	.10630894 06 .850-01	-.0117
124332	60	12	.10631784 06 .850-01	.0059
124432	60	12	.10632675 06 .850-01	.0176
124532	60	12	.10633566 06 .850-01	-.0098
124632	60	12	.10634457 06 .850-01	.0068
124732	60	12	.10635350 06 .850-01	-.0156
124832	60	12	.10636242 06 .850-01	.0078
124932	60	12	.10637136 06 .850-01	.0098
125032	60	12	.10638029 06 .850-01	-.0098
125132	60	12	.10638923 06 .850-01	-.0020

STATION NUMBER 12 64/07/30 ITERATION NUMBER 2 PASS NUMBER 07/302

FREQUENCY 8200.0

TIME	TC	Q	CC3	
125232	60	12	.10639818 06	.850-01 .0029
125332	60	12	.10640713 06	.850-01 -.0117
125432	60	12	.10641608 06	.850-01 .0020
125532	60	12	.10642504 06	.850-01 -.0049
125632	60	12	.10643400 06	.850-01 .0186
125732	60	12	.10644296 06	.850-01 -.0127
125832	60	12	.10645193 06	.850-01 .0049
125932	60	12	.10646090 06	.850-01 .0020
130032	60	12	.10646987 06	.850-01 -.0029
130132	60	12	.10647884 06	.850-01 -.0098
130232	60	12	.10648782 06	.850-01 .0137
130332	60	12	.10649680 06	.850-01 .0020
130432	60	12	.10650578 06	.850-01 .0059
130532	60	12	.10651476 06	.850-01 -.0088
130632	60	12	.10652374 06	.850-01 .0078
130732	60	12	.10653273 06	.850-01 -.0107
130832	60	12	.10654171 06	.850-01 .0049
130932	60	12	.10655069 06	.850-01 -.0137
131032	60	12	.10655968 06	.850-01 .0000
131132	60	12	.10656867 06	.850-01 .0137
131232	60	12	.10657765 06	.850-01 -.0059
131332	60	12	.10658664 06	.850-01 -.0088
131432	60	12	.10659563 06	.850-01 .0059
131532	60	12	.10660461 06	.850-01 .0039
131632	60	12	.10661360 06	.850-01 .0020
131732	60	12	.10662258 06	.850-01 -.0146
131832	60	12	.10663156 06	.850-01 .0029
131932	60	12	.10664054 06	.850-01 .0059
132032	60	12	.10664952 06	.850-01 .0098
132132	60	12	.10665850 06	.850-01 -.0010
132232	60	12	.10666748 06	.850-01 -.0107
132332	60	12	.10667645 06	.850-01 -.0010
132432	60	12	.10668542 06	.850-01 .0117
132532	60	12	.10669439 06	.850-01 -.0059
132632	60	12	.10670335 06	.850-01 -.0049
132732	60	12	.10671232 06	.850-01 .0000
132832	60	12	.10672127 06	.850-01 -.0088
132932	60	12	.10673023 06	.850-01 .0020
133032	60	12	.10673918 06	.850-01 .0000
133132	60	12	.10674813 06	.850-01 .0020
133232	60	12	.10675707 06	.850-01 .0088
133332	60	12	.10676601 06	.850-01 -.0137
133432	60	12	.10677495 06	.850-01 .0010
133532	60	12	.10678388 06	.850-01 .0049
133632	60	12	.10679280 06	.850-01 -.0039
133732	60	12	.10680172 06	.850-01 .0088
133832	60	12	.10681064 06	.850-01 -.0049
133932	60	12	.10681955 06	.850-01 .0029
134032	60	12	.10682845 06	.850-01 -.0010
134132	60	12	.10683735 06	.850-01 .0020
134232	60	12	.10684624 06	.850-01 -.0059
134332	60	12	.10685512 06	.850-01 .0098
134432	60	12	.10686400 06	.850-01 -.0010
134532	60	12	.10687287 06	.850-01 -.0059
134632	60	12	.10688174 06	.850-01 -.0039
134732	60	12	.10689059 06	.850-01 .0068
134832	60	12	.10689944 06	.850-01 -.0098
134932	60	12	.10690828 06	.850-01 .0156
135032	60	12	.10691712 06	.850-01 -.0186
135132	60	12	.10692594 06	.850-01 .0049
135232	60	12	.10693476 06	.850-01 .0049
135332	60	12	.10694357 06	.850-01 -.0049
135432	60	12	.10695237 06	.850-01 -.0059
135532	60	12	.10696116 06	.850-01 .0020
135632	60	12	.10696995 06	.850-01 -.0137
135732	60	12	.10697872 06	.850-01 .0127
135832	60	12	.10698748 06	.850-01 -.0176
135932	60	12	.10699624 06	.850-01 .0127
140032	60	12	.10700498 06	.850-01 .0010
140132	60	12	.10701372 06	.850-01 .0000
140232	60	12	.10702244 06	.850-01 -.0068
140332	60	12	.10703115 06	.850-01 -.0029
140432	60	12	.10703986 06	.850-01 .0107
140532	60	12	.10704855 06	.850-01 -.0137
140632	60	12	.10705723 06	.850-01 .0049
140732	60	12	.10706590 06	.850-01 .0029
140832	60	12	.10707455 06	.850-01 -.0049
140932	60	12	.10708320 06	.850-01 -.0010
141032	60	12	.10709183 06	.850-01 -.0020
141132	60	12	.10710046 06	.850-01 .0088
141232	60	12	.10710907 06	.850-01 .0000
141332	60	12	.10711766 06	.850-01 .0020
141432	60	12	.10712625 06	.850-01 .0020
141532	60	12	.10713482 06	.850-01 -.0029
141632	60	12	.10714338 06	.850-01 -.0117
141732	60	12	.10715192 06	.850-01 .0098
141832	60	12	.10716045 06	.850-01 -.0059
141932	60	12	.10716897 06	.850-01 .0098
142032	60	12	.10717748 06	.850-01 -.0107
142132	60	12	.10718597 06	.850-01 -.0010
142232	60	12	.10719444 06	.850-01 .0068
142332	60	12	.10720290 06	.850-01 -.0039
142432	60	12	.10721135 06	.850-01 .0000
142532	60	12	.10721978 06	.850-01 .0020
142632	60	12	.10722820 06	.850-01 .0020
142732	60	12	.10723660 06	.850-01 .0010
142832	60	12	.10724498 06	.850-01 -.0020
142932	60	12	.10725335 06	.850-01 .0117
143032	60	12	.10726171 06	.850-01 -.0098
143132	60	12	.10727005 06	.850-01 -.0137
143232	60	12	.10727837 06	.850-01 .0137
143332	60	12	.10728667 06	.850-01 .0078
143432	60	12	.10729496 06	.850-01 -.0137
143532	60	12	.10730323 06	.850-01 -.0029

STATION NUMBER 12 64/07/30 ITERATION NUMBER 2 PASS NUMBER 07/302

FREQUENCY 8200.0

TIME	TC	Q	CC3	
143632	60	12	.10731149 06 .850-01	.0098
143732	60	12	.10731973 06 .850-01	.0039
143832	60	12	.10732795 06 .850-01	.0010
143932	60	12	.10733615 06 .850-01	-.0020
144032	60	12	.10734434 06 .850-01	-.0029
144132	60	12	.10735250 06 .850-01	-.0029
144232	60	12	.10736065 06 .850-01	-.0029
144332	60	12	.10736878 06 .850-01	.0010
144432	60	12	.10737689 06 .850-01	.0215
144532	60	12	.10738499 06 .850-01	-.0049
144632	60	12	.10739306 06 .850-01	-.0127
144732	60	12	.10740112 06 .850-01	-.0010
144832	60	12	.10740915 06 .850-01	.0293
144932	60	12	.10741717 06 .850-01	-.0205
145032	60	12	.10742517 06 .850-01	-.0010
145132	60	12	.10743314 06 .850-01	.0049
145232	60	12	.10744110 06 .850-01	.0156
145332	60	12	.10744904 06 .850-01	-.0049
145432	60	12	.10745695 06 .850-01	-.0049
145532	60	12	.10746485 06 .850-01	.0000
145632	60	12	.10747273 06 .850-01	.0068
145732	60	12	.10748058 06 .850-01	-.0127
145832	60	12	.10748841 06 .850-01	.0039
145932	60	12	.10749622 06 .850-01	.0088
150032	60	12	.10750401 06 .850-01	.0020
150132	60	12	.10751178 06 .850-01	.0000
150232	60	12	.10751953 06 .850-01	.0029
150332	60	12	.10752725 06 .850-01	-.0039
150432	60	12	.10753496 06 .850-01	.0088
150532	60	12	.10754264 06 .850-01	-.0039
150632	60	12	.10755029 06 .850-01	.0049
150732	60	12	.10755793 06 .850-01	.0029
150832	60	12	.10756554 06 .850-01	-.0078
150932	60	12	.10757313 06 .850-01	.0029
151032	60	12	.10758069 06 .850-01	.0039
151132	60	12	.10758824 06 .850-01	-.0059
151232	60	12	.10759576 06 .850-01	.0098
151332	60	12	.10760325 06 .850-01	-.0010
151432	60	12	.10761072 06 .850-01	-.0068
151532	60	12	.10761817 06 .850-01	-.0029
151632	60	12	.10762559 06 .850-01	.0088
151732	60	12	.10763299 06 .850-01	.0107
151832	60	12	.10764036 06 .850-01	-.0127
151932	60	12	.10764771 06 .850-01	.0049
152032	60	12	.10765503 06 .850-01	-.0010
152132	60	12	.10766233 06 .850-01	.0010
152232	60	12	.10766961 06 .850-01	-.0059
152332	60	12	.10767685 06 .850-01	.0137
152432	60	12	.10768407 06 .850-01	-.0078
152532	60	12	.10769127 06 .850-01	-.0039
152632	60	12	.10769844 06 .850-01	.0088
152732	60	12	.10770558 06 .850-01	-.0010
152832	60	12	.10771270 06 .850-01	-.0029
152932	60	12	.10771979 06 .850-01	.0068
153032	60	12	.10772686 06 .850-01	.0088
153132	60	12	.10773389 06 .850-01	.0049
153232	60	12	.10774090 06 .850-01	.0107
153332	60	12	.10774789 06 .850-01	-.0059
153432	60	12	.10775484 06 .850-01	-.0117
153532	60	12	.10776177 06 .850-01	-.0068
153632	60	12	.10776867 06 .850-01	.0078
153732	60	12	.10777555 06 .850-01	.0020
153832	60	12	.10778239 06 .850-01	-.0098
153932	60	12	.10778921 06 .850-01	.0059
154032	60	12	.10779600 06 .850-01	.0010
154132	60	12	.10780276 06 .850-01	.0068
154232	60	12	.10780949 06 .850-01	.0088
154332	60	12	.10781619 06 .850-01	-.0117
154432	60	12	.10782287 06 .850-01	-.0029
154532	60	12	.10782951 06 .850-01	.0029
154632	60	12	.10783613 06 .850-01	.0029
154732	60	12	.10784272 06 .850-01	-.0010
154832	60	12	.10784927 06 .850-01	-.0068
154932	60	12	.10785580 06 .850-01	.0146
155032	60	12	.10786230 06 .850-01	.0010
155132	60	12	.10786877 06 .850-01	.0000
155332	60	12	.10788161 06 .850-01	.0039
155432	60	12	.10788799 06 .850-01	-.0068
155532	60	12	.10789433 06 .850-01	-.0020
155632	60	12	.10790065 06 .850-01	.0146
155732	60	12	.10790693 06 .850-01	-.0195
155832	60	12	.10791319 06 .850-01	.0088
155932	60	12	.10791941 06 .850-01	.0029
160032	60	12	.10792560 06 .850-01	.0117
160132	60	12	.10793176 06 .850-01	-.0137
160232	60	12	.10793789 06 .850-01	.0234
160332	60	12	.10794399 06 .850-01	-.0068
160432	60	12	.10795005 06 .850-01	-.0215
160532	60	12	.10795609 06 .850-01	.0127
160632	60	12	.10796209 06 .850-01	-.0049
160732	60	12	.10796806 06 .850-01	.0098
160832	60	12	.10797399 06 .850-01	-.0098
160932	60	12	.10797990 06 .850-01	.0039
161032	60	12	.10798577 06 .850-01	.0000
161132	60	12	.10799160 06 .850-01	-.0049
161232	60	12	.10799741 06 .850-01	.0059
161332	60	12	.10800318 06 .850-01	.0010
161432	60	12	.10800892 06 .850-01	-.0039
161532	60	12	.10801463 06 .850-01	-.0098
161632	60	12	.10802030 06 .850-01	.0029
161732	60	12	.10802594 06 .850-01	.0137
161832	60	12	.10803154 06 .850-01	-.0068
161932	60	12	.10803711 06 .850-01	.0059
162032	60	12	.10804265 06 .850-01	-.0146

STATION NUMBER 12 64/07/30 ITERATION NUMBER 2 PASS NUMBER 07/302

FREQUENCY 8200.0

TIME	TC	Q	CC3		
162132	60	12	.10804815	06 .850-01	.0166
162232	60	12	.10805362	06 .850-01	-.0010
162332	60	12	.10805905	06 .850-01	-.0010
162432	60	12	.10806445	06 .850-01	-.0010
162532	60	12	.10806981	06 .850-01	.0020
162632	60	12	.10807514	06 .850-01	-.0107
162732	60	12	.10808044	06 .850-01	.0107
162832	60	12	.10808570	06 .850-01	.0010
162932	60	12	.10809092	06 .850-01	-.0068
163032	60	12	.10809611	06 .850-01	.0049
163132	60	12	.10810127	06 .850-01	.0010
163232	60	12	.10810638	06 .850-01	-.0010
163332	60	12	.10811146	06 .850-01	.0166
163432	60	12	.10811651	06 .850-01	.0039
163532	60	12	.10812152	06 .850-01	-.0068
163632	60	12	.10812650	06 .850-01	.0010
163732	60	12	.10813144	06 .850-01	-.0049
163832	60	12	.10813634	06 .850-01	.0098
163932	60	12	.10814120	06 .850-01	.0098
164032	60	12	.10814603	06 .850-01	-.0020
164132	60	12	.10815083	06 .850-01	-.0117
164232	60	12	.10815558	06 .850-01	-.0020
164332	60	12	.10816030	06 .850-01	.0117
164432	60	12	.10816499	06 .850-01	-.0049
164532	60	12	.10816963	06 .850-01	.0000
164632	60	12	.10817424	06 .850-01	.0088
164732	60	12	.10817881	06 .850-01	.0049
164832	60	12	.10818335	06 .850-01	-.0039
164932	60	12	.10818784	06 .850-01	-.0088
165032	60	12	.10819230	06 .850-01	.0156
165132	60	12	.10819672	06 .850-01	-.0059
165232	60	12	.10820110	06 .850-01	-.0049
165332	60	12	.10820545	06 .850-01	.0156
165432	60	12	.10820976	06 .850-01	-.0078
165532	60	12	.10821403	06 .850-01	.0068
165632	60	12	.10821826	06 .850-01	.0088
165732	60	12	.10822245	06 .850-01	-.0010
165832	60	12	.10822660	06 .850-01	-.0049
165932	60	12	.10823072	06 .850-01	-.0039
170032	60	12	.10823480	06 .850-01	.0029
170132	60	12	.10823883	06 .850-01	.0146
170232	60	12	.10824283	06 .850-01	-.0020
170332	60	12	.10824680	06 .850-01	.0039
170432	60	12	.10825072	06 .850-01	-.0010
170532	60	12	.10825460	06 .850-01	.0166
170632	60	12	.10825844	06 .850-01	-.0107
170732	60	12	.10826225	06 .850-01	.0029
170832	60	12	.10826601	06 .850-01	.0049
170932	60	12	.10826974	06 .850-01	-.0049
171032	60	12	.10827342	06 .850-01	.0098
171132	60	12	.10827707	06 .850-01	-.0020
171232	60	12	.10828067	06 .850-01	.0078
171332	60	12	.10828424	06 .850-01	-.0088
171432	60	12	.10828777	06 .850-01	.0156
171532	60	12	.10829125	06 .850-01	.0127
171632	60	12	.10829470	06 .850-01	.0146
171732	60	12	.10829811	06 .850-01	-.0078
171832	60	12	.10830147	06 .850-01	-.0068
171932	60	12	.10830480	06 .850-01	.0010
172032	60	12	.10830808	06 .850-01	-.0010
172132	60	12	.10831133	06 .850-01	.0039
172232	60	12	.10831453	06 .850-01	.0010
172332	60	12	.10831770	06 .850-01	.0029
172432	60	12	.10832082	06 .850-01	-.0020
172532	60	12	.10832390	06 .850-01	-.0010
172632	60	12	.10832694	06 .850-01	.0078
172732	60	12	.10832994	06 .850-01	.0078
172832	60	12	.10833290	06 .850-01	-.0176
172932	60	12	.10833582	06 .850-01	.0156
173032	60	12	.10833869	06 .850-01	.0049
173132	60	12	.10834153	06 .850-01	.0039
173232	60	12	.10834432	06 .850-01	-.0078
173332	60	12	.10834707	06 .850-01	-.0098
173432	60	12	.10834979	06 .850-01	.0127
173532	60	12	.10835246	06 .850-01	-.0078
173632	60	12	.10835508	06 .850-01	-.0020
173732	60	12	.10835767	06 .850-01	.0127
173832	60	12	.10836021	06 .850-01	.0010
173932	60	12	.10836272	06 .850-01	-.0020
174032	60	12	.10836518	06 .850-01	-.0117
174132	60	12	.10836760	06 .850-01	.0029
174232	60	12	.10836997	06 .850-01	.0098
174332	60	12	.10837231	06 .850-01	.0088
174432	60	12	.10837460	06 .850-01	.0000
174532	60	12	.10837685	06 .852-01	.0000
174632	60	12	.10837906	06 .852-01	-.0078
174732	60	12	.10838122	06 .852-01	.0088
174832	60	12	.10838335	06 .852-01	.0029
174932	60	12	.10838543	06 .852-01	-.0107
175032	60	12	.10838746	06 .852-01	.0010
175132	60	12	.10838946	06 .852-01	.0049
175232	60	12	.10839141	06 .852-01	.0020
175332	60	12	.10839332	06 .852-01	.0088
175432	60	12	.10839519	06 .852-01	-.0088
175532	60	12	.10839702	06 .852-01	.0000
175632	60	12	.10839880	06 .852-01	.0020

STATION NUMBER 12 64/07/30 ITERATION NUMBER 2 PASS NUMBER 07/303

FREQUENCY 8200.0

TIME	TC	Q	CC3		
175732	60	12	.10840054	06 .852-01	-.0039
175832	60	12	.10840223	06 .852-01	-.0010
175932	60	12	.10840389	06 .852-01	-.0039
180032	60	12	.10840550	06 .854-01	.0195
180132	60	12	.10840706	06 .854-01	-.0137
180232	60	12	.10840859	06 .854-01	.0117
180332	60	12	.10841007	06 .854-01	-.0020
180432	60	12	.10841151	06 .854-01	-.0059
180532	60	12	.10841290	06 .854-01	.0000
180632	60	12	.10841425	06 .854-01	-.0010
180732	60	12	.10841556	06 .854-01	-.0088
180832	60	12	.10841682	06 .857-01	.0107
180932	60	12	.10841804	06 .857-01	.0068
181032	60	12	.10841922	06 .857-01	-.0215
181132	60	12	.10842035	06 .857-01	.0117
181232	60	12	.10842144	06 .857-01	-.0117
181332	60	12	.10842249	06 .857-01	.0088
181432	60	12	.10842349	06 .859-01	-.0117
181532	60	12	.10842445	06 .859-01	-.0039
181632	60	12	.10842537	06 .859-01	.0137
181732	60	12	.10842624	06 .862-01	.0088
181832	60	12	.10842707	06 .862-01	-.0195
181932	60	12	.10842785	06 .862-01	.0127
182032	60	12	.10842859	06 .862-01	.0049
182132	60	12	.10842929	06 .864-01	-.0244
182232	60	12	.10842994	06 .864-01	.0049
182332	60	12	.10843055	06 .867-01	-.0039
182432	60	12	.10843112	06 .867-01	-.0020
182532	60	12	.10843164	06 .869-01	.0098
182632	60	12	.10843212	06 .869-01	-.0010
182732	60	12	.10843255	06 .872-01	.0000
182832	60	12	.10843294	06 .872-01	-.0068
182932	60	12	.10843328	06 .874-01	-.0010
183032	60	12	.10843358	06 .876-01	-.0020
183132	60	12	.10843384	06 .879-01	-.0088
183232	60	12	.10843405	06 .881-01	.0107
183332	60	12	.10843422	06 .881-01	-.0078
183432	60	12	.10843435	06 .884-01	.0010
183532	60	12	.10843443	06 .889-01	-.0137
183632	60	12	.10843447	06 .891-01	.0000
183732	60	12	.10843446	06 .894-01	.0078
183832	60	12	.10843441	06 .898-01	-.0068
183932	60	12	.10843431	06 .901-01	.0068
184032	60	12	.10843417	06 .906-01	-.0029
184132	60	12	.10843398	06 .911-01	-.0020
184232	60	12	.10843375	06 .916-01	-.0059
184332	60	12	.10843348	06 .920-01	.0000
184432	60	12	.10843316	06 .928-01	.0010
184532	60	12	.10843280	06 .933-01	-.0039
184632	60	12	.10843240	06 .940-01	-.0156
184732	60	12	.10843195	06 .950-01	.0010
184832	60	12	.10843145	06 .957-01	-.0049
184932	60	12	.10843091	06 .967-01	.0000
185032	60	12	.10843033	06 .979-01	-.0166
185132	60	12	.10842971	06 .991-01	-.0078
185232	60	12	.10842904	06 .100 00	-.0029
185332	60	12	.10842832	06 .102 00	-.0039
185432	60	12	.10842756	06 .104 00	-.0117
185532	60	12	.10842676	06 .105 00	-.0078
185632	60	12	.10842591	06 .107 00	-.0107
185732	60	12	.10842502	06 .110 00	-.0186

STATION NUMBER 12 64/07/31 ITERATION NUMBER 2 PASS NUMBER 07/311

FREQUENCY 8200.0

TIME	TC	Q	CC3	
073432	60	12	.10297812 06 .940-01	.0078
073532	60	12	.10297912 06 .933-01	.0156
073632	60	12	.10298016 06 .925-01	.0039
073732	60	12	.10298126 06 .920-01	.0068
073832	60	12	.10298241 06 .913-01	-.0107
073932	60	12	.10298361 06 .908-01	.0205
074032	60	12	.10298487 06 .903-01	-.0010
074132	60	12	.10298617 06 .901-01	.0068
074232	60	12	.10298754 06 .896-01	.0137
074332	60	12	.10298895 06 .894-01	.0000
074432	60	12	.10299042 06 .889-01	-.0166
074532	60	12	.10299193 06 .886-01	.0137
074632	60	12	.10299351 06 .884-01	.0088
074732	60	12	.10299513 06 .881-01	.0000
074832	60	12	.10299681 06 .879-01	.0059
074932	60	12	.10299854 06 .876-01	-.0088
075032	60	12	.10300032 06 .876-01	.0234
075132	60	12	.10300216 06 .874-01	-.0146
075232	60	12	.10300405 06 .872-01	-.0049
075332	60	12	.10300600 06 .872-01	.0176
075432	60	12	.10300800 06 .869-01	-.0137
075532	60	12	.10301004 06 .869-01	.0205
075632	60	12	.10301215 06 .867-01	-.0010
075732	60	12	.10301431 06 .867-01	-.0078
075832	60	12	.10301652 06 .864-01	.0156
075932	60	12	.10301878 06 .864-01	.0010
080032	60	12	.10302110 06 .862-01	.0000
080132	60	12	.10302347 06 .862-01	.0117
080232	60	12	.10302590 06 .862-01	-.0127
080332	60	12	.10302837 06 .859-01	.0088
080432	60	12	.10303091 06 .859-01	.0098
080532	60	12	.10303349 06 .859-01	.0078
080632	60	12	.10303613 06 .859-01	.0020
080732	60	12	.10303882 06 .857-01	-.0078
080832	60	12	.10304157 06 .857-01	-.0049
080932	60	12	.10304437 06 .857-01	.0107
081032	60	12	.10304723 06 .857-01	.0059
081132	60	12	.10305014 06 .857-01	-.0029
081232	60	12	.10305310 06 .854-01	.0020
081332	60	12	.10305611 06 .854-01	.0020
081432	60	12	.10305918 06 .854-01	-.0020
081532	60	12	.10306231 06 .854-01	.0068
081632	60	12	.10306549 06 .854-01	-.0049
081732	60	12	.10306872 06 .854-01	-.0049
081832	60	12	.10307201 06 .854-01	.0088
081932	60	12	.10307535 06 .854-01	.0010

STATION NUMBER 12 64/07/31 ITERATION NUMBER 2 PASS NUMBER 07/312

FREQUENCY 8200.0

TIME	TC	Q	CC3	
082032	60	12	.10307874 06 .852-01	.0059
082132	60	12	.10308219 06 .852-01	-.0107
082232	60	12	.10308570 06 .852-01	.0186
082332	60	12	.10308925 06 .852-01	-.0225
082432	60	12	.10309287 06 .852-01	-.0010
082532	60	12	.10309653 06 .852-01	.0156
082632	60	12	.10310026 06 .852-01	-.0059
082732	60	12	.10310403 06 .852-01	.0186
082832	60	12	.10310786 06 .852-01	.0049
082932	60	12	.10311175 06 .852-01	-.0137
083032	60	12	.10311569 06 .852-01	.0137
083132	60	12	.10311968 06 .852-01	-.0137
083232	60	12	.10312373 06 .852-01	.0039
083332	60	12	.10312783 06 .852-01	.0010
083432	60	12	.10313199 06 .852-01	.0098
083532	60	12	.10313620 06 .852-01	-.0029
083632	60	12	.10314047 06 .850-01	-.0039
083732	60	12	.10314479 06 .850-01	-.0098
083832	60	12	.10314917 06 .850-01	.0127
083932	60	12	.10315360 06 .850-01	-.0020
084032	60	12	.10315809 06 .850-01	-.0059
084132	60	12	.10316263 06 .850-01	.0020
084232	60	12	.10316723 06 .850-01	.0039
084332	60	12	.10317188 06 .850-01	.0020
084432	60	12	.10317659 06 .850-01	-.0049
084532	60	12	.10318135 06 .850-01	-.0010
084632	60	12	.10318617 06 .850-01	-.0020
084732	60	12	.10319104 06 .850-01	.0088
084832	60	12	.10319597 06 .850-01	-.0029
084932	60	12	.10320095 06 .850-01	-.0029
085032	60	12	.10320599 06 .850-01	-.0088
085132	60	12	.10321108 06 .850-01	.0146
085232	60	12	.10321624 06 .850-01	-.0195
085332	60	12	.10322144 06 .850-01	.0088
085432	60	12	.10322670 06 .850-01	-.0020
085532	60	12	.10323202 06 .850-01	-.0010
085632	60	12	.10323739 06 .850-01	-.0068
085732	60	12	.10324282 06 .850-01	-.0010
085832	60	12	.10324830 06 .850-01	.0000
085932	60	12	.10325384 06 .850-01	-.0068
090032	60	12	.10325943 06 .850-01	.0146
090132	60	12	.10326508 06 .850-01	-.0020
090232	60	12	.10327079 06 .850-01	-.0088
090332	60	12	.10327655 06 .850-01	.0117
090432	60	12	.10328237 06 .850-01	-.0078
090532	60	12	.10328825 06 .850-01	.0010
090632	60	12	.10329418 06 .850-01	-.0146
090732	60	12	.10330017 06 .850-01	.0146
090832	60	12	.10330621 06 .850-01	-.0117
090932	60	12	.10331231 06 .850-01	.0049
091032	60	12	.10331847 06 .850-01	-.0020
091132	60	12	.10332468 06 .850-01	.0020

STATION NUMBER 12 64/07/31 ITERATION NUMBER 2 PASS NUMBER 07/312

FREQUENCY 8200.0

TIME	TC	Q	CC3	
091232	60	12	.10333095 06 .850-01	-.0010
091332	60	12	.10333728 06 .850-01	.0068
091432	60	12	.10334366 06 .850-01	-.0098
091532	60	12	.10335010 06 .850-01	.0020
091632	60	12	.10335659 06 .850-01	-.0117
091732	60	12	.10336315 06 .850-01	.0020
091832	60	12	.10336976 06 .850-01	.0088
091932	60	12	.10337642 06 .850-01	-.0088
092032	60	12	.10338315 06 .850-01	.0010
092132	60	12	.10338993 06 .850-01	.0029
092232	60	12	.10339677 06 .850-01	-.0020
092332	60	12	.10340366 06 .850-01	.0010
092432	60	12	.10341062 06 .850-01	-.0020
092532	60	12	.10341763 06 .850-01	.0039
092632	60	12	.10342470 06 .850-01	-.0146
092732	60	12	.10343182 06 .850-01	.0098
092832	60	12	.10343901 06 .850-01	-.0068
092932	60	12	.10344625 06 .850-01	.0010
093032	60	12	.10345355 06 .850-01	.0010
093132	60	12	.10346090 06 .850-01	.0098
093232	60	12	.10346832 06 .850-01	-.0059
093332	60	12	.10347580 06 .850-01	.0039
093432	60	12	.10348333 06 .850-01	-.0127
093532	60	12	.10349092 06 .850-01	.0127
093632	60	12	.10349857 06 .850-01	-.0029
093732	60	12	.10350628 06 .850-01	.0059
093832	60	12	.10351404 06 .850-01	-.0117
093932	60	12	.10352187 06 .850-01	-.0039
094032	60	12	.10352976 06 .850-01	.0107
094132	60	12	.10353770 06 .850-01	.0000
094232	60	12	.10354570 06 .850-01	-.0039
094332	60	12	.10355376 06 .850-01	.0010
094432	60	12	.10356189 06 .850-01	-.0059
094532	60	12	.10357007 06 .850-01	.0127
094632	60	12	.10357831 06 .850-01	.0049
094732	60	12	.10358661 06 .850-01	-.0146
094832	60	12	.10359498 06 .850-01	.0068
094932	60	12	.10360340 06 .850-01	.0020
095032	60	12	.10361188 06 .850-01	.0020
095132	60	12	.10362042 06 .850-01	-.0078
095232	60	12	.10362903 06 .850-01	.0059
095332	60	12	.10363769 06 .850-01	.0068
095432	60	12	.10364642 06 .850-01	-.0020
095532	60	12	.10365520 06 .850-01	-.0049
095632	60	12	.10366405 06 .850-01	-.0029
095732	60	12	.10367296 06 .850-01	.0029
095832	60	12	.10368193 06 .850-01	-.0020
095932	60	12	.10369097 06 .850-01	-.0020
100032	60	12	.10370006 06 .850-01	.0029
100132	60	12	.10370922 06 .850-01	-.0059
100232	60	12	.10371844 06 .850-01	.0234
100332	60	12	.10372773 06 .850-01	-.0098
100432	60	12	.10373707 06 .850-01	-.0059
100532	60	12	.10374648 06 .850-01	.0010
100632	60	12	.10375595 06 .850-01	-.0049
100732	60	12	.10376549 06 .850-01	.0098
100832	60	12	.10377509 06 .850-01	-.0078
100932	60	12	.10378475 06 .850-01	.0117
101032	60	12	.10379448 06 .850-01	-.0020
101132	60	12	.10380428 06 .850-01	-.0107
101232	60	12	.10381414 06 .850-01	.0137
101332	60	12	.10382406 06 .850-01	-.0088
101432	60	12	.10383405 06 .850-01	.0186
101532	60	12	.10384410 06 .850-01	-.0186
101632	60	12	.10385422 06 .850-01	.0098
101732	60	12	.10386441 06 .850-01	-.0098
101832	60	12	.10387466 06 .850-01	.0205
101932	60	12	.10388498 06 .850-01	-.0166
102032	60	12	.10389537 06 .850-01	.0137
102132	60	12	.10390582 06 .850-01	-.0078
102232	60	12	.10391635 06 .850-01	.0029
102332	60	12	.10392694 06 .850-01	-.0039
102432	60	12	.10393759 06 .850-01	.0039
102532	60	12	.10394832 06 .850-01	.0088
102632	60	12	.10395912 06 .850-01	-.0049
102732	60	12	.10396999 06 .850-01	-.0059
102832	60	12	.10398092 06 .850-01	.0078
102932	60	12	.10399193 06 .850-01	.0000
103032	60	12	.10400301 06 .850-01	.0068
103332	60	12	.10403667 06 .850-01	.0098
103432	60	12	.10404804 06 .850-01	-.0059
103732	60	12	.10408257 06 .850-01	.0088
103832	60	12	.10409423 06 .850-01	-.0020
103932	60	12	.10410597 06 .850-01	-.0039
104232	60	12	.10414163 06 .850-01	.0029
104332	60	12	.10415367 06 .850-01	-.0039
104432	60	12	.10416579 06 .850-01	-.0049
104532	60	12	.10417798 06 .850-01	.0156
104632	60	12	.10419026 06 .850-01	-.0098
104732	60	12	.10420261 06 .850-01	.0020
104832	60	12	.10421505 06 .850-01	.0010
104932	60	12	.10422756 06 .850-01	.0020
105032	60	12	.10424016 06 .850-01	.0049
105132	60	12	.10425284 06 .850-01	-.0078
105232	60	12	.10426560 06 .850-01	.0137
105532	60	12	.10430439 06 .850-01	.0059
105632	60	12	.10431749 06 .850-01	.0049
105732	60	12	.10433068 06 .850-01	.0166
105832	60	12	.10434396 06 .850-01	.0078

STATION NUMBER 12 64/07/31 ITERATION NUMBER 2 PASS NUMBER 07/313

FREQUENCY 8200.0

TIME	TC	Q	CC3	
110232	60	12	.10439795 06 .201 00	.0625
110332	60	12	.10441168 06 .201 00	-.0146
110432	60	12	.10442550 06 .201 00	.0156
110532	60	12	.10443942 06 .201 00	-.0986
110832	60	12	.10448173 06 .201 00	-.0166
110932	60	12	.10449603 06 .201 00	-.0518
111032	60	12	.10451044 06 .201 00	-.0693
111132	60	12	.10452494 06 .201 00	.0459
111232	60	12	.10453954 06 .201 00	.0254
111632	60	12	.10459900 06 .202 00	.0469
111732	60	12	.10461414 06 .202 00	-.0039
111832	60	12	.10462938 06 .202 00	-.0313
111932	60	12	.10464474 06 .202 00	-.0381
112032	60	12	.10466021 06 .202 00	-.0234
112132	60	12	.10467579 06 .202 00	-.0078
112232	60	12	.10469149 06 .202 00	.0088
112332	60	12	.10470731 06 .202 00	-.0107
112632	60	12	.10475549 06 .202 00	-.0293
112732	60	12	.10477180 06 .202 00	.0117
112832	60	12	.10478824 06 .202 00	.0078
112932	60	12	.10480481 06 .202 00	-.0264
113032	60	12	.10482151 06 .202 00	-.0596
113132	60	12	.10483834 06 .202 00	-.0078
113232	60	12	.10485531 06 .202 00	-.0098
113332	60	12	.10487242 06 .202 00	-.0010
113432	60	12	.10488966 06 .202 00	-.0488
113532	60	12	.10490706 06 .202 00	.0596
113832	60	12	.10496011 06 .202 00	-.0488
113932	60	12	.10497811 06 .202 00	.0098
114032	60	12	.10499625 06 .202 00	-.0029
114132	60	12	.10501456 06 .202 00	-.0107
114232	60	12	.10503303 06 .202 00	.0361
114332	60	12	.10505166 06 .202 00	.0000
114432	60	12	.10507047 06 .202 00	-.0557
114532	60	12	.10508945 06 .202 00	-.0010
114632	60	12	.10510861 06 .202 00	.0107
114732	60	12	.10512794 06 .202 00	-.0078
114832	60	12	.10514746 06 .202 00	-.0264
114932	60	12	.10516717 06 .202 00	.0000
115032	60	12	.10518706 06 .202 00	.0020
115132	60	12	.10520716 06 .202 00	-.0264
115232	60	12	.10522745 06 .202 00	-.0049
115332	60	12	.10524795 06 .202 00	-.0049
115432	60	12	.10526866 06 .202 00	-.0146
115532	60	12	.10528959 06 .202 00	.0430
115632	60	12	.10531073 06 .202 00	-.0508
115732	60	12	.10533210 06 .202 00	-.0205
115832	60	12	.10535370 06 .202 00	.0459
115932	60	12	.10537554 06 .203 00	-.0244
120032	60	12	.10539762 06 .203 00	-.0039
120132	60	12	.10541995 06 .203 00	.0352
120232	60	12	.10544253 06 .203 00	-.0127
120332	60	12	.10546537 06 .203 00	-.0234
120432	60	12	.10548849 06 .203 00	-.0361
120532	60	12	.10551187 06 .203 00	.0098
120632	60	12	.10553554 06 .203 00	-.0439
120732	60	12	.10555951 06 .203 00	.0439
120832	60	12	.10558377 06 .203 00	-.0518
120932	60	12	.10560834 06 .203 00	-.0039
121032	60	12	.10563322 06 .203 00	-.0244
121132	60	12	.10565843 06 .203 00	.0469
121232	60	12	.10568398 06 .203 00	-.0342
121332	60	12	.10570988 06 .203 00	-.0117
121432	60	12	.10573613 06 .203 00	-.0127
121532	60	12	.10576275 06 .203 00	-.0488
121632	60	12	.10578974 06 .203 00	.0371
121732	60	12	.10581714 06 .203 00	-.0039
121832	60	12	.10584493 06 .203 00	-.0479
121932	60	12	.10587314 06 .203 00	.0059
122032	60	12	.10590179 06 .203 00	-.0215
122132	60	12	.10593088 06 .203 00	.0693
122232	60	12	.10596043 06 .203 00	.0488
122332	60	12	.10599047 06 .203 00	-.0176
122432	60	12	.10602099 06 .203 00	.0049

STATION NUMBER 12 64/07/31 ITERATION NUMBER 2 PASS NUMBER 07/314

FREQUENCY 8200.0

TIME	TC	Q	CC3	
122548	60	12	.10606041 06 .203 00	.0273
122623	10	12	.10607882 06 .500 00	-.1211
122758	60	12	.10612984 06 .203 00	.0410
122833	10	12	.10614897 06 .500 00	-.0723
122958	60	12	.10619636 06 .203 00	.0166
123043	30	12	.10622193 06 .288 00	.0000
123208	60	12	.10627129 06 .203 00	-.0244
123308	60	12	.10630694 06 .203 00	-.0117
123408	60	12	.10634331 06 .203 00	-.0146
123443	10	12	.10636484 06 .500 00	-.1445
123618	60	12	.10642473 06 .203 00	.0215
123718	60	12	.10646358 06 .203 00	-.0166
123818	60	12	.10650330 06 .204 00	.0371
123918	60	12	.10654391 06 .204 00	.0088
124018	60	12	.10658546 06 .204 00	-.0098
124118	60	12	.10662860 06 .204 00	.0361
124158	20	12	.10665689 06 .354 00	.1621
124303	10	12	.10670491 06 .502 00	.0859
124408	60	12	.10675431 06 .204 00	.0195
124508	60	12	.10680111 06 .204 00	.0234
124608	60	12	.10684916 06 .204 00	-.0264
124653	30	12	.10688602 06 .288 00	.0498
124808	60	12	.10694930 06 .204 00	.0527
124908	60	12	.10700154 06 .204 00	-.0361
125008	60	12	.10705533 06 .204 00	.0156
125108	60	12	.10711078 06 .204 00	.0176
125208	60	12	.10716798 06 .204 00	-.0146
125258	40	12	.10721702 06 .250 00	-.0420
125418	60	12	.10729845 06 .204 00	.0352
125518	60	12	.10736195 06 .204 00	.0137
125608	40	12	.10741654 06 .250 00	.0791
125743	50	12	.10752507 06 .224 00	.0264
125928	40	12	.10765281 06 .250 00	-.0576
130023	10	12	.10772331 06 .502 00	-.0098
130133	30	12	.10781711 06 .289 00	-.0098
130318	40	12	.10796701 06 .250 00	.0176
130438	60	12	.10808961 06 .204 00	-.0303
130538	60	12	.10818678 06 .204 00	-.0156
130638	60	12	.10828894 06 .204 00	.0068
130718	20	12	.10835984 06 .354 00	.0625
130828	40	12	.10849066 06 .250 00	.0420
130958	60	12	.10867208 06 .205 00	-.0479
131058	60	12	.10880223 06 .205 00	.0156
131158	60	12	.10894080 06 .205 00	.0137
131258	60	12	.10908877 06 .205 00	-.0381
131358	60	12	.10924729 06 .205 00	.0967
131458	60	12	.10941770 06 .205 00	-.0889
131558	60	12	.10960163 06 .205 00	.0215
131658	60	12	.10980097 06 .205 00	.0273
131758	60	12	.11001805 06 .205 00	-.0479
131858	60	12	.11025566 06 .205 00	.0332
131938	20	12	.11042618 06 .355 00	.0166
132048	60	12	.11075673 06 .205 00	.0020
132143	50	12	.11104601 06 .225 00	-.0146
132308	60	12	.11156074 06 .205 00	.0771
132408	60	12	.11198449 06 .205 00	.0049
132443	10	12	.11225748 06 .506 00	-.0830
132533	30	12	.11269622 06 .290 00	.0459

DATA STATISTICS STATION 3 ITERATION 2

PASS	DATA TYPE	BEGINNING TIME	END TIME	NUMBER OF POINTS	STD DEV	RMS	FIRST MOMENT	SECOND MOMENT
07/291	CC3	7/29-104132	7/29-112732	31	.116-01	.116-01	-.756-03	.135-03
07/292	CC3	7/29-113132	7/29-175032	341	.847-02	.854-02	.114-02	.730-04
07/293	CC3	7/29-175132	7/29-184132	42	.953-02	.159-01	-.127-01	.253-03
07/301	CC3	7/30-071832	7/30-082232	62	.104-01	.111-01	.381-02	.123-03
07/302	CC3	7/30-082332	7/30-175632	564	.890-02	.890-02	-.102-03	.792-04
07/303	CC3	7/30-175732	7/30-185732	61	.921-02	.953-02	-.245-02	.909-04
07/311	CC3	7/31-073432	7/31-081932	46	.971-02	.102-01	.304-02	.104-03
07/312	CC3	7/31-082032	7/31-105832	151	.885-02	.886-02	.485-03	.785-04
07/313	CC3	7/31-110232	7/31-122432	74	.334-01	.341-01	-.694-02	.116-02
07/314	CC3	7/31-122548	7/31-132533	58	.511-01	.514-01	.475-02	.264-02

STATION NUMBER 41 64707/29 ITERATION NUMBER 2 PASS NUMBER 07/292

FREQUENCY 8249.3

TIME	TC	Q	CC3	
184632	60	41	.10817721 06 .136 00	.0049
184732	60	41	.10818446 06 .136 00	.0078
184832	60	41	.10819172 06 .136 00	.0078
184932	60	41	.10819901 06 .136 00	.0078
185032	60	41	.10820631 06 .136 00	.0049
185132	60	41	.10821363 06 .136 00	.0176
185232	60	41	.10822097 06 .136 00	-.0215
185332	60	41	.10822833 06 .136 00	.0059
185432	60	41	.10823570 06 .136 00	.0322
185532	60	41	.10824309 06 .136 00	.0088
185632	60	41	.10825050 06 .136 00	-.0322
185732	60	41	.10825792 06 .137 00	.0273
185832	60	41	.10826536 06 .137 00	.0029
185932	60	41	.10827282 06 .137 00	-.0039
190032	60	41	.10828029 06 .137 00	.0068
190132	60	41	.10828778 06 .137 00	.0010
190232	60	41	.10829529 06 .137 00	-.0205
190332	60	41	.10830281 06 .137 00	.0264
190832	60	41	.10834063 06 .137 00	.0020
191232	60	41	.10837115 06 .137 00	.0186
191332	60	41	.10837881 06 .137 00	.0068
191432	60	41	.10838649 06 .137 00	.0146
191532	60	41	.10839417 06 .137 00	.0254
191632	60	41	.10840188 06 .137 00	.0068
191732	60	41	.10840959 06 .137 00	-.0234
191832	60	41	.10841731 06 .137 00	.0176
191932	60	41	.10842505 06 .137 00	.0127
192332	60	41	.10845612 06 .137 00	-.0049
192432	60	41	.10846391 06 .137 00	.0166
192532	60	41	.10847172 06 .137 00	.0117
192632	60	41	.10847954 06 .137 00	-.0205
192732	60	41	.10848736 06 .137 00	.0195
192832	60	41	.10849520 06 .138 00	.0166
192932	60	41	.10850304 06 .138 00	-.0117
193032	60	41	.10851090 06 .138 00	-.0020
193132	60	41	.10851876 06 .138 00	-.0332
193232	60	41	.10852664 06 .138 00	.0264
193332	60	41	.10853452 06 .138 00	.0264
193432	60	41	.10854241 06 .138 00	.0176
193532	60	41	.10855031 06 .138 00	.0010
193632	60	41	.10855822 06 .138 00	-.0078
193732	60	41	.10856614 06 .138 00	.0254
193832	60	41	.10857406 06 .138 00	-.0313
194132	60	41	.10859788 06 .138 00	-.0166
194232	60	41	.10860584 06 .138 00	.0293
194332	60	41	.10861380 06 .138 00	.0195
194432	60	41	.10862176 06 .138 00	.0029
194532	60	41	.10862974 06 .138 00	-.0049
194632	60	41	.10863772 06 .138 00	.0156
194732	60	41	.10864570 06 .138 00	-.0186
195032	60	41	.10866969 06 .138 00	.0098
195132	60	41	.10867769 06 .138 00	.0205
195232	60	41	.10868571 06 .138 00	-.0244
195332	60	41	.10869372 06 .138 00	-.0068
195432	60	41	.10870174 06 .138 00	-.0098
195532	60	41	.10870976 06 .138 00	.0176
195632	60	41	.10871779 06 .138 00	-.0107
195732	60	41	.10872582 06 .138 00	.0078
200032	60	41	.10874994 06 .139 00	.0098
200132	60	41	.10875798 06 .139 00	.0000
200232	60	41	.10876603 06 .139 00	-.0127
200332	60	41	.10877408 06 .139 00	.0225
200432	60	41	.10878213 06 .139 00	-.0117
200532	60	41	.10879018 06 .139 00	-.0146
200632	60	41	.10879823 06 .139 00	-.0020
200732	60	41	.10880629 06 .139 00	.0098
200832	60	41	.10881435 06 .139 00	-.0137
200932	60	41	.10882240 06 .139 00	.0283
201032	60	41	.10883046 06 .139 00	.0029
201132	60	41	.10883852 06 .139 00	-.0215
201232	60	41	.10884658 06 .139 00	.0186
201332	60	41	.10885464 06 .139 00	.0088
201432	60	41	.10886270 06 .139 00	.0322
201532	60	41	.10887076 06 .139 00	-.0088
201632	60	41	.10887882 06 .139 00	-.0010
201732	60	41	.10888687 06 .139 00	.0078
201832	60	41	.10889493 06 .139 00	-.0313
201932	60	41	.10890298 06 .139 00	.0137
202032	60	41	.10891104 06 .139 00	.0264
202132	60	41	.10891909 06 .139 00	-.0264
202232	60	41	.10892714 06 .139 00	-.0098
202332	60	41	.10893519 06 .139 00	.0244
202432	60	41	.10894324 06 .139 00	-.0039
202532	60	41	.10895128 06 .139 00	.0195
202632	60	41	.10895932 06 .139 00	-.0039
202732	60	41	.10896736 06 .139 00	.0088
202832	60	41	.10897539 06 .140 00	.0068
202932	60	41	.10898342 06 .140 00	-.0068
203032	60	41	.10899145 06 .140 00	-.0010
203132	60	41	.10899947 06 .140 00	.0088
203232	60	41	.10900749 06 .140 00	.0234
203332	60	41	.10901551 06 .140 00	-.0078
203432	60	41	.10902352 06 .140 00	.0156
203532	60	41	.10903152 06 .140 00	.0098
203632	60	41	.10903952 06 .140 00	.0088
203732	60	41	.10904752 06 .140 00	-.0195
203832	60	41	.10905551 06 .140 00	-.0098
203932	60	41	.10906349 06 .140 00	-.0283
204232	60	41	.10908741 06 .140 00	-.0127
204332	60	41	.10909537 06 .140 00	-.0215
204632	60	41	.10911921 06 .140 00	-.0264
204732	60	41	.10912714 06 .140 00	.0078
204832	60	41	.10913506 06 .140 00	.0342
204932	60	41	.10914298 06 .140 00	.0186

STATION NUMBER 41 64/07/29 ITERATION NUMBER 2 PASS NUMBER 07/292

FREQUENCY 8249.3

TIME	TC	Q	CC3	
205032	60	41	.10915089 06 .140 00	.0098
205132	60	41	.10915879 06 .140 00	-.0068
205232	60	41	.10916668 06 .140 00	-.0156
205332	60	41	.10917456 06 .140 00	.0020
205432	60	41	.10918244 06 .140 00	-.0059
205532	60	41	.10919030 06 .140 00	-.0039
205632	60	41	.10919816 06 .141 00	.0068
205732	60	41	.10920600 06 .141 00	.0107
205832	60	41	.10921384 06 .141 00	-.0254
205932	60	41	.10922167 06 .141 00	.0137
210032	60	41	.10922948 06 .141 00	-.0029
210132	60	41	.10923729 06 .141 00	-.0088
210232	60	41	.10924509 06 .141 00	.0293
210332	60	41	.10925287 06 .141 00	.0107
210432	60	41	.10926064 06 .141 00	.0039
210532	60	41	.10926841 06 .141 00	.0244
210632	60	41	.10927616 06 .141 00	-.0107
210732	60	41	.10928390 06 .141 00	.0000
210832	60	41	.10929163 06 .141 00	.0225
210932	60	41	.10929934 06 .141 00	-.0098
211032	60	41	.10930705 06 .141 00	.0029
211132	60	41	.10931474 06 .141 00	-.0049
211632	60	41	.10935300 06 .141 00	.0186
211732	60	41	.10936061 06 .141 00	-.0107
211832	60	41	.10936821 06 .141 00	.0234
211932	60	41	.10937579 06 .141 00	-.0264
212032	60	41	.10938336 06 .141 00	.0371
212132	60	41	.10939092 06 .141 00	-.0176
212232	60	41	.10939846 06 .141 00	.0244
212332	60	41	.10940598 06 .141 00	-.0176
212432	60	41	.10941349 06 .142 00	.0059
212532	60	41	.10942099 06 .142 00	.0117
212632	60	41	.10942847 06 .142 00	.0146
212732	60	41	.10943593 06 .142 00	-.0156
212832	60	41	.10944338 06 .142 00	-.0137
212932	60	41	.10945081 06 .142 00	.0215
213032	60	41	.10945823 06 .142 00	-.0107
213132	60	41	.10946562 06 .142 00	-.0088
213532	60	41	.10949505 06 .142 00	-.0010
213632	60	41	.10950236 06 .142 00	-.0313
213732	60	41	.10950966 06 .142 00	.0400
213832	60	41	.10951694 06 .142 00	.0293
213932	60	41	.10952419 06 .142 00	-.0137
214032	60	41	.10953144 06 .142 00	-.0039
214132	60	41	.10953866 06 .142 00	-.0098
214232	60	41	.10954586 06 .142 00	.0205
214332	60	41	.10955305 06 .142 00	.0195
214432	60	41	.10956021 06 .142 00	-.0303
214532	60	41	.10956736 06 .142 00	.0234
214632	60	41	.10957449 06 .142 00	-.0039
214732	60	41	.10958159 06 .142 00	.0234
215032	60	41	.10960279 06 .142 00	.0225
215132	60	41	.10960982 06 .143 00	.0127
215232	60	41	.10961682 06 .143 00	-.0098
215332	60	41	.10962381 06 .143 00	-.0283
215432	60	41	.10963077 06 .143 00	.0078
215532	60	41	.10963772 06 .143 00	.0146
215632	60	41	.10964464 06 .143 00	-.0225
215932	60	41	.10966527 06 .143 00	.0107
220032	60	41	.10967211 06 .143 00	-.0234
220132	60	41	.10967892 06 .143 00	.0156
220232	60	41	.10968571 06 .143 00	.0098
220332	60	41	.10969247 06 .143 00	.0098
220432	60	41	.10969921 06 .143 00	.0000
220532	60	41	.10970594 06 .143 00	-.0361
220632	60	41	.10971263 06 .143 00	.0332
220932	60	41	.10973258 06 .143 00	.0176
221032	60	41	.10973918 06 .143 00	.0146
221132	60	41	.10974576 06 .143 00	.0049
221232	60	41	.10975232 06 .143 00	.0166
221332	60	41	.10975884 06 .143 00	-.0283
221432	60	41	.10976535 06 .143 00	.0176
221532	60	41	.10977183 06 .143 00	.0049
221632	60	41	.10977828 06 .143 00	-.0156
221732	60	41	.10978471 06 .144 00	.0039
221832	60	41	.10979111 06 .144 00	.0176
221932	60	41	.10979749 06 .144 00	.0391
222032	60	41	.10980384 06 .144 00	-.0127
222132	60	41	.10981017 06 .144 00	-.0068
222232	60	41	.10981647 06 .144 00	.0098
222332	60	41	.10982275 06 .144 00	.0029
222432	60	41	.10982899 06 .144 00	.0049
222532	60	41	.10983521 06 .144 00	.0342
222632	60	41	.10984141 06 .144 00	-.0107
222732	60	41	.10984758 06 .144 00	-.0273
223032	60	41	.10986592 06 .144 00	-.0166
223132	60	41	.10987197 06 .144 00	-.0078
223232	60	41	.10987800 06 .144 00	.0293
223532	60	41	.10989593 06 .144 00	-.0098
223632	60	41	.10990184 06 .144 00	.0400
223732	60	41	.10990773 06 .144 00	-.0156
223832	60	41	.10991359 06 .144 00	-.0078
223932	60	41	.10991942 06 .144 00	-.0225
224032	60	41	.10992522 06 .144 00	.0088
224132	60	41	.10993100 06 .144 00	.0039
224232	60	41	.10993674 06 .144 00	.0273
224332	60	41	.10994245 06 .145 00	-.0029
224432	60	41	.10994814 06 .145 00	-.0039
224532	60	41	.10995379 06 .145 00	-.0068
224632	60	41	.10995941 06 .145 00	.0186
224732	60	41	.10996501 06 .145 00	-.0078
224832	60	41	.10997057 06 .145 00	.0117
224932	60	41	.10997610 06 .145 00	-.0205
225032	60	41	.10998161 06 .145 00	.0107

STATION NUMBER 41 64/07/29 ITERATION NUMBER 2 PASS NUMBER 07/292

FREQUENCY 8249.3

TIME	TC	Q	CC3	
225132	60	41	.10998708 06 .145 00	.0234
225232	60	41	.10999252 06 .145 00	.0166
225332	60	41	.10999793 06 .145 00	.0234
225432	60	41	.11000330 06 .145 00	-.0205
225532	60	41	.11000865 06 .145 00	.0156
225632	60	41	.11001396 06 .145 00	.0010
225732	60	41	.11001925 06 .145 00	.0020
225832	60	41	.11002450 06 .145 00	.0176
225932	60	41	.11002972 06 .145 00	-.0029
230032	60	41	.11003490 06 .145 00	-.0225
230132	60	41	.11004006 06 .145 00	-.0107
230232	60	41	.11004518 06 .145 00	.0332
230332	60	41	.11005027 06 .145 00	.0107
230432	60	41	.11005533 06 .145 00	.0039
230532	60	41	.11006035 06 .145 00	.0127
230632	60	41	.11006534 06 .145 00	-.0117
230732	60	41	.11007030 06 .145 00	.0146
230832	60	41	.11007523 06 .146 00	.0059
230932	60	41	.11008012 06 .146 00	-.0342
231232	60	41	.11009459 06 .146 00	-.0225
231332	60	41	.11009934 06 .146 00	.0215
231432	60	41	.11010407 06 .146 00	-.0166
231532	60	41	.11010875 06 .146 00	.0127
231832	60	41	.11012261 06 .146 00	-.0088
231932	60	41	.11012716 06 .146 00	.0078
232032	60	41	.11013167 06 .146 00	-.0059
232132	60	41	.11013615 06 .146 00	.0146
232232	60	41	.11014059 06 .146 00	-.0117
232332	60	41	.11014500 06 .146 00	-.0029
232432	60	41	.11014938 06 .146 00	-.0107
232532	60	41	.11015371 06 .146 00	.0020
232632	60	41	.11015801 06 .146 00	.0176
232732	60	41	.11016228 06 .146 00	.0020
232832	60	41	.11016651 06 .146 00	.0215
232932	60	41	.11017070 06 .146 00	-.0225
233032	60	41	.11017486 06 .146 00	.0029
233132	60	41	.11017898 06 .146 00	.0156
233232	60	41	.11018307 06 .146 00	.0137
233732	60	41	.11020294 06 .146 00	.0059
233832	60	41	.11020681 06 .146 00	-.0068
233932	60	41	.11021063 06 .146 00	-.0166
234032	60	41	.11021442 06 .146 00	.0107
234132	60	41	.11021817 06 .146 00	.0088
234232	60	41	.11022189 06 .146 00	-.0049
234332	60	41	.11022556 06 .146 00	.0029
234432	60	41	.11022920 06 .146 00	.0137
234532	60	41	.11023280 06 .147 00	-.0195
234632	60	41	.11023636 06 .147 00	.0176
234732	60	41	.11023989 06 .147 00	.0107
235132	60	41	.11025360 06 .147 00	.0137
235232	60	41	.11025693 06 .147 00	.0156
235332	60	41	.11026023 06 .147 00	-.0107
235432	60	41	.11026348 06 .147 00	.0020
235532	60	41	.11026669 06 .147 00	-.0127
235632	60	41	.11026987 06 .147 00	-.0215
235732	60	41	.11027301 06 .147 00	.0254
235832	60	41	.11027610 06 .147 00	.0107
235932	60	41	.11027916 06 .147 00	.0029
			64/07/30	
000032	60	41	.11028218 06 .147 00	-.0166
000132	60	41	.11028516 06 .147 00	.0215
000232	60	41	.11028810 06 .147 00	.0156
000332	60	41	.11029100 06 .147 00	-.0176
000432	60	41	.11029386 06 .147 00	.0068
000532	60	41	.11029668 06 .147 00	.0205
000632	60	41	.11029946 06 .147 00	-.0254
000732	60	41	.11030220 06 .147 00	-.0146
000832	60	41	.11030490 06 .148 00	.0029
000932	60	41	.11030755 06 .148 00	-.0049
001032	60	41	.11031017 06 .148 00	.0098
001132	60	41	.11031275 06 .148 00	.0332
001232	60	41	.11031529 06 .148 00	-.0205
001332	60	41	.11031778 06 .148 00	.0156
001432	60	41	.11032024 06 .148 00	-.0234
001532	60	41	.11032265 06 .148 00	.0117
001632	60	41	.11032503 06 .148 00	-.0107
001732	60	41	.11032736 06 .148 00	.0225
001832	60	41	.11032965 06 .148 00	-.0186
001932	60	41	.11033190 06 .148 00	.0146
002032	60	41	.11033411 06 .148 00	-.0117
002132	60	41	.11033628 06 .148 00	.0049
002232	60	41	.11033840 06 .148 00	.0117
002332	60	41	.11034049 06 .148 00	-.0234

STATION NUMBER 41 64/07/30 ITERATION NUMBER 2 PASS NUMBER 07/293

FREQUENCY 8249.3

TIME	TC	Q	CC3	
002432	60	41	.11034253 06 .148 00	.0010
002532	60	41	.11034453 06 .148 00	.0000
002632	60	41	.11034649 06 .148 00	.0068
002732	60	41	.11034841 06 .148 00	-.0107
002832	60	41	.11035029 06 .149 00	.0137
002932	60	41	.11035212 06 .149 00	-.0215
003032	60	41	.11035391 06 .149 00	-.0137
003132	60	41	.11035566 06 .149 00	-.0127
003232	60	41	.11035737 06 .149 00	.0127
003332	60	41	.11035903 06 .149 00	-.0352
003432	60	41	.11036066 06 .149 00	-.0088
003532	60	41	.11036224 06 .149 00	-.0059
003632	60	41	.11036378 06 .149 00	-.0107
003732	60	41	.11036527 06 .149 00	.0107
003832	60	41	.11036672 06 .149 00	.0068
003932	60	41	.11036814 06 .149 00	-.0029
004032	60	41	.11036950 06 .149 00	.0127
004132	60	41	.11037083 06 .149 00	-.0117
004232	60	41	.11037211 06 .150 00	-.0107
004332	60	41	.11037335 06 .150 00	.0000
004432	60	41	.11037454 06 .150 00	.0371
004532	60	41	.11037570 06 .150 00	.0000
004632	60	41	.11037681 06 .150 00	-.0098
004732	60	41	.11037787 06 .150 00	.0068
004832	60	41	.11037890 06 .150 00	-.0010
004932	60	41	.11037988 06 .150 00	-.0146
005032	60	41	.11038082 06 .150 00	-.0020
005132	60	41	.11038171 06 .150 00	-.0127
005232	60	41	.11038256 06 .151 00	.0039
005532	60	41	.11038485 06 .151 00	-.0205
005632	60	41	.11038553 06 .151 00	.0195
005732	60	41	.11038616 06 .151 00	.0029
005832	60	41	.11038675 06 .151 00	-.0020
005932	60	41	.11038730 06 .152 00	.0020
010032	60	41	.11038780 06 .152 00	.0000
010132	60	41	.11038826 06 .152 00	-.0078
010232	60	41	.11038867 06 .152 00	-.0225
010332	60	41	.11038904 06 .153 00	-.0254
010632	60	41	.11038989 06 .153 00	-.0234
010732	60	41	.11039008 06 .154 00	-.0010
010832	60	41	.11039023 06 .154 00	-.0186
010932	60	41	.11039034 06 .155 00	.0088
011532	60	41	.11039005 06 .158 00	-.0186
011632	60	41	.11038985 06 .159 00	.0010
011732	60	41	.11038960 06 .160 00	-.0020
011832	60	41	.11038931 06 .161 00	.0059
011932	60	41	.11038897 06 .162 00	-.0088
012032	60	41	.11038859 06 .163 00	-.0283
012132	60	41	.11038817 06 .165 00	.0117
012232	60	41	.11038770 06 .167 00	-.0195
012332	60	41	.11038719 06 .168 00	.0088
012432	60	41	.11038663 06 .170 00	-.0166
012532	60	41	.11038603 06 .173 00	.0010
012632	60	41	.11038539 06 .175 00	.0293
013232	60	41	.11038059 06 .202 00	.0254
013332	60	41	.11037964 06 .209 00	-.0225
013432	60	41	.11037864 06 .217 00	.0068
013532	60	41	.11037760 06 .227 00	.0127
013632	60	41	.11037652 06 .237 00	-.0215
013732	60	41	.11037540 06 .250 00	.0361
014032	60	41	.11037177 06 .302 00	.0029

STATION NUMBER 41 64/07/30 ITERATION NUMBER 2 PASS NUMBER 07/302

FREQUENCY 8149.6

TIME	TC	Q	CC3	
190132	60	41	.10522805 06 .178 00	.0137
190232	60	41	.10523720 06 .179 00	.0166
190332	60	41	.10524636 06 .179 00	-.0283
190432	60	41	.10525554 06 .179 00	.0098
190532	60	41	.10526474 06 .179 00	-.0361
190632	60	41	.10527395 06 .179 00	.0195
190732	60	41	.10528317 06 .179 00	.0098
190832	60	41	.10529241 06 .179 00	-.0322
191232	60	41	.10532953 06 .179 00	-.0010
191332	60	41	.10533885 06 .179 00	.0156
191432	60	41	.10534818 06 .179 00	-.0322
191532	60	41	.10535753 06 .179 00	.0068
191632	60	41	.10536688 06 .179 00	.0146
191732	60	41	.10537626 06 .179 00	-.0078
191832	60	41	.10538564 06 .179 00	.0225
192232	60	41	.10542332 06 .179 00	.0166
192332	60	41	.10543277 06 .179 00	.0166
192432	60	41	.10544223 06 .179 00	.0215
192732	60	41	.10547068 06 .179 00	-.0029
192832	60	41	.10548019 06 .179 00	-.0273
192932	60	41	.10548971 06 .179 00	.0371
193032	60	41	.10549924 06 .179 00	-.0107
193132	60	41	.10550878 06 .179 00	-.0186
193432	60	41	.10553747 06 .179 00	-.0039
193532	60	41	.10554705 06 .179 00	-.0020
193632	60	41	.10555664 06 .179 00	.0234
193732	60	41	.10556624 06 .179 00	.0068
193832	60	41	.10557585 06 .179 00	-.0195
193932	60	41	.10558547 06 .179 00	.0283
194032	60	41	.10559510 06 .179 00	-.0322
194132	60	41	.10560473 06 .179 00	.0313
194432	60	41	.10563369 06 .179 00	.0078
194532	60	41	.10564336 06 .180 00	.0068
194632	60	41	.10565303 06 .180 00	-.0010
194732	60	41	.10566272 06 .180 00	-.0010
194832	60	41	.10567241 06 .180 00	-.0068
194932	60	41	.10568210 06 .180 00	-.0361
195032	60	41	.10569181 06 .180 00	.0107
195132	60	41	.10570151 06 .180 00	.0352
195232	60	41	.10571123 06 .180 00	-.0137
195332	60	41	.10572095 06 .180 00	.0146
195432	60	41	.10573068 06 .180 00	.0049
195532	60	41	.10574041 06 .180 00	.0059
195832	60	41	.10576964 06 .180 00	-.0215
195932	60	41	.10577939 06 .180 00	.0098
200032	60	41	.10578915 06 .180 00	.0195
200132	60	41	.10579891 06 .180 00	-.0078
200232	60	41	.10580867 06 .180 00	.0117
200332	60	41	.10581844 06 .180 00	-.0068
200432	60	41	.10582821 06 .180 00	.0049
200532	60	41	.10583799 06 .180 00	.0137
200832	60	41	.10586733 06 .180 00	.0039
200932	60	41	.10587711 06 .180 00	.0176
201032	60	41	.10588690 06 .180 00	-.0205
201132	60	41	.10589669 06 .180 00	.0225
201232	60	41	.10590648 06 .180 00	-.0195
201332	60	41	.10591628 06 .180 00	.0039
201432	60	41	.10592607 06 .180 00	-.0078
201532	60	41	.10593587 06 .180 00	-.0039
201932	60	41	.10597506 06 .180 00	-.0605
202032	60	41	.10598486 06 .180 00	.0410
202132	60	41	.10599466 06 .180 00	-.0068
202232	60	41	.10600445 06 .180 00	.0117
202332	60	41	.10601425 06 .180 00	-.0186
202432	60	41	.10602405 06 .180 00	-.0137
202532	60	41	.10603384 06 .181 00	-.0088
202632	60	41	.10604364 06 .181 00	.0303
202732	60	41	.10605343 06 .181 00	.0215
202832	60	41	.10606322 06 .181 00	-.0029
202932	60	41	.10607301 06 .181 00	.0264
203032	60	41	.10608279 06 .181 00	-.0264
203132	60	41	.10609258 06 .181 00	-.0264
203232	60	41	.10610236 06 .181 00	.0244
203332	60	41	.10611214 06 .181 00	-.0039
203432	60	41	.10612191 06 .181 00	.0039
203532	60	41	.10613168 06 .181 00	.0156
203632	60	41	.10614145 06 .181 00	.0293
203732	60	41	.10615122 06 .181 00	-.0020
204032	60	41	.10618049 06 .181 00	-.0059
204132	60	41	.10619024 06 .181 00	.0137
204232	60	41	.10619998 06 .181 00	.0205
204332	60	41	.10620972 06 .181 00	-.0020
204432	60	41	.10621945 06 .181 00	-.0176
204532	60	41	.10622918 06 .181 00	-.0117
204632	60	41	.10623890 06 .181 00	-.0166
204732	60	41	.10624861 06 .181 00	.0342
204832	60	41	.10625833 06 .181 00	.0068
204932	60	41	.10626803 06 .181 00	-.0127
205032	60	41	.10627773 06 .181 00	-.0107
205132	60	41	.10628742 06 .181 00	-.0010
205232	60	41	.10629710 06 .181 00	-.0010
205332	60	41	.10630677 06 .181 00	-.0264
205632	60	41	.10633576 06 .181 00	-.0098
205732	60	41	.10634541 06 .181 00	-.0068
205832	60	41	.10635504 06 .181 00	.0068
205932	60	41	.10636467 06 .181 00	.0107
210032	60	41	.10637429 06 .181 00	.0078
210132	60	41	.10638390 06 .181 00	-.0371
210232	60	41	.10639351 06 .181 00	.0107
210632	60	41	.10643182 06 .182 00	.0146
210732	60	41	.10644137 06 .182 00	.0273
210832	60	41	.10645091 06 .182 00	-.0156
210932	60	41	.10646045 06 .182 00	.0176
211032	60	41	.10646997 06 .182 00	.0303

STATION NUMBER 41 64/07/30 ITERATION NUMBER 2 PASS NUMBER 07/302

FREQUENCY 8149.6

TIME	TC	Q	CC3	
211332	60	41	.10649847 06 .182 00	.0137
211432	60	41	.10650795 06 .182 00	-.0293
211532	60	41	.10651741 06 .182 00	.0225
211632	60	41	.10652686 06 .182 00	.0039
211732	60	41	.10653630 06 .182 00	-.0029
211832	60	41	.10654573 06 .182 00	-.0156
211932	60	41	.10655515 06 .182 00	.0029
212032	60	41	.10656455 06 .182 00	.0176
212132	60	41	.10657394 06 .182 00	-.0225
212232	60	41	.10658331 06 .182 00	.0352
212332	60	41	.10659268 06 .182 00	-.0107
212432	60	41	.10660203 06 .182 00	-.0088
212532	60	41	.10661136 06 .182 00	.0059
212632	60	41	.10662068 06 .182 00	-.0146
212732	60	41	.10662999 06 .182 00	.0127
212832	60	41	.10663928 06 .182 00	.0039
212932	60	41	.10664856 06 .182 00	.0264
213032	60	41	.10665782 06 .182 00	-.0195
213132	60	41	.10666707 06 .182 00	.0000
213232	60	41	.10667630 06 .182 00	.0186
213332	60	41	.10668551 06 .182 00	-.0313
213432	60	41	.10669471 06 .182 00	.0186
213532	60	41	.10670390 06 .182 00	-.0156
213632	60	41	.10671307 06 .182 00	.0166
213732	60	41	.10672222 06 .182 00	.0137
213832	60	41	.10673135 06 .183 00	.0117
213932	60	41	.10674047 06 .183 00	-.0234
214232	60	41	.10676772 06 .183 00	-.0098
214332	60	41	.10677677 06 .183 00	-.0088
214432	60	41	.10678581 06 .183 00	.0098
214532	60	41	.10679482 06 .183 00	-.0205
214632	60	41	.10680382 06 .183 00	.0166
214732	60	41	.10681279 06 .183 00	.0234
215032	60	41	.10683961 06 .183 00	.0039
215132	60	41	.10684851 06 .183 00	.0020
215232	60	41	.10685740 06 .183 00	.0029
215332	60	41	.10686626 06 .183 00	-.0098
215432	60	41	.10687510 06 .183 00	-.0195
215532	60	41	.10688393 06 .183 00	-.0098
215632	60	41	.10689273 06 .183 00	.0205
215732	60	41	.10690151 06 .183 00	-.0117
215832	60	41	.10691027 06 .183 00	-.0234
215932	60	41	.10691901 06 .183 00	.0010
220032	60	41	.10692773 06 .183 00	-.0029
220132	60	41	.10693644 06 .183 00	-.0029
220232	60	41	.10694511 06 .183 00	.0195
220332	60	41	.10695377 06 .183 00	.0127
220432	60	41	.10696241 06 .183 00	-.0225
220532	60	41	.10697102 06 .183 00	.0146
220632	60	41	.10697961 06 .183 00	-.0098
220732	60	41	.10698818 06 .183 00	.0205
220832	60	41	.10699672 06 .183 00	.0078
220932	60	41	.10700525 06 .183 00	-.0186
221032	60	41	.10701375 06 .183 00	.0000
221332	60	41	.10703911 06 .184 00	-.0322
221432	60	41	.10704752 06 .184 00	.0107
221532	60	41	.10705591 06 .184 00	.0088
221632	60	41	.10706427 06 .184 00	-.0010
221732	60	41	.10707260 06 .184 00	.0283
221832	60	41	.10708092 06 .184 00	-.0166
221932	60	41	.10708920 06 .184 00	-.0215
222032	60	41	.10709747 06 .184 00	.0156
222132	60	41	.10710570 06 .184 00	-.0059
222232	60	41	.10711392 06 .184 00	.0146
222332	60	41	.10712211 06 .184 00	-.0068
222432	60	41	.10713027 06 .184 00	-.0029
222532	60	41	.10713841 06 .184 00	-.0068
222632	60	41	.10714652 06 .184 00	.0156
222732	60	41	.10715460 06 .184 00	-.0039
222832	60	41	.10716266 06 .184 00	.0029
222932	60	41	.10717070 06 .184 00	-.0303
223032	60	41	.10717870 06 .184 00	.0293
223132	60	41	.10718668 06 .184 00	-.0176
223232	60	41	.10719464 06 .184 00	.0127
223332	60	41	.10720256 06 .184 00	-.0137
223432	60	41	.10721046 06 .184 00	.0029
223532	60	41	.10721833 06 .184 00	-.0020
223632	60	41	.10722618 06 .184 00	.0195
223732	60	41	.10723400 06 .184 00	-.0146
223832	60	41	.10724179 06 .184 00	.0303
223932	60	41	.10724955 06 .184 00	.0020
224032	60	41	.10725728 06 .184 00	-.0146
224632	60	41	.10730308 06 .185 00	.0361
224732	60	41	.10731061 06 .185 00	.0205
224832	60	41	.10731811 06 .185 00	-.0146
224932	60	41	.10732559 06 .185 00	-.0371
225032	60	41	.10733303 06 .185 00	.0205
225132	60	41	.10734044 06 .185 00	.0068
225232	60	41	.10734783 06 .185 00	-.0254
225332	60	41	.10735518 06 .185 00	.0381
225432	60	41	.10736250 06 .185 00	-.0176
225532	60	41	.10736979 06 .185 00	.0254
225632	60	41	.10737705 06 .185 00	-.0020
225932	60	41	.10739865 06 .185 00	.0020
230032	60	41	.10740578 06 .185 00	.0000
230132	60	41	.10741289 06 .185 00	-.0049
230232	60	41	.10741996 06 .185 00	-.0117
230332	60	41	.10742700 06 .185 00	.0146
230432	60	41	.10743401 06 .185 00	-.0107
230532	60	41	.10744099 06 .185 00	-.0059
230632	60	41	.10744793 06 .185 00	.0000
230732	60	41	.10745484 06 .185 00	.0215
230832	60	41	.10746172 06 .185 00	.0078
230932	60	41	.10746857 06 .185 00	-.0049

STATION NUMBER 41 64/07/30 ITERATION NUMBER 2 PASS NUMBER 07/302

FREQUENCY 8149.6

TIME	TC	Q	CC3
231032	60	41	.10747539 06 .185 00 -.0195
231132	60	41	.10748217 06 .185 00 .0000
231232	60	41	.10748891 06 .185 00 .0352
231332	60	41	.10749563 06 .185 00 -.0117
231432	60	41	.10750231 06 .185 00 .0234
231732	60	41	.10752215 06 .186 00 -.0332
231832	60	41	.10752869 06 .186 00 -.0205
231932	60	41	.10753521 06 .186 00 -.0068
232032	60	41	.10754168 06 .186 00 .0156
232132	60	41	.10754813 06 .186 00 .0068
232432	60	41	.10756724 06 .186 00 .0049
232932	60	41	.10759841 06 .186 00 .0068
233032	60	41	.10760453 06 .186 00 .0313
233132	60	41	.10761062 06 .186 00 .0244
233232	60	41	.10761668 06 .186 00 .0195
233332	60	41	.10762270 06 .186 00 .0186

DATA STATISTICS STATION 4 ITERATION 2

PASS	DATA TYPE	BEGINNING TIME	END TIME	NUMBER OF POINTS	STD DEV	RMS	FIRST MOMENT	SECOND MOMENT
07/292	CC3	7/29-184632	7/30-002332	290	.170-01	.172-01	.259-02	.295-03
07/293	CC3	7/30-002432	7/30-014032	61	.151-01	.154-01	-.266-02	.236-03
07/302	CC3	7/30-190132	7/30-233332	224	.183-01	.184-01	.168-02	.337-03

STATION NUMBER 51 64/07/30 ITERATION NUMBER 2 PASS NUMBER 07/302

FREQUENCY 8224.7

TIME	TC	Q	CC3
015232	60	51	.10681091 06 .150 00 -.0127
015332	60	51	.10681926 06 .150 00 -.0059
015432	60	51	.10682762 06 .150 00 -.0049
015732	60	51	.10685285 06 .150 00 -.0146
015832	60	51	.10686130 06 .150 00 .0010
015932	60	51	.10686977 06 .150 00 -.0049
020032	60	51	.10687826 06 .150 00 -.0146
020132	60	51	.10688678 06 .150 00 .0049
020232	60	51	.10689531 06 .150 00 .0049
020532	60	51	.10692103 06 .150 00 -.0166
020632	60	51	.10692964 06 .150 00 .0039
020732	60	51	.10693828 06 .150 00 .0059
020832	60	51	.10694693 06 .150 00 -.0127
020932	60	51	.10695560 06 .150 00 .0010
021032	60	51	.10696429 06 .150 00 -.0039
021132	60	51	.10697299 06 .150 00 -.0117
021232	60	51	.10698172 06 .150 00 .0137
021332	60	51	.10699046 06 .150 00 .0205
021432	60	51	.10699922 06 .150 00 -.0059
021732	60	51	.10702561 06 .150 00 .0088
021832	60	51	.10703444 06 .150 00 -.0039
021932	60	51	.10704328 06 .150 00 .0176
022032	60	51	.10705214 06 .150 00 -.0107
022132	60	51	.10706102 06 .150 00 -.0049
022232	60	51	.10706991 06 .150 00 -.0156
022332	60	51	.10707882 06 .150 00 .0078
022432	60	51	.10708775 06 .150 00 -.0176
022532	60	51	.10709669 06 .151 00 .0088
022632	60	51	.10710564 06 .151 00 -.0127
022732	60	51	.10711461 06 .151 00 .0176
022832	60	51	.10712360 06 .151 00 -.0010
022932	60	51	.10713260 06 .151 00 .0010
023032	60	51	.10714161 06 .151 00 .0205
023132	60	51	.10715064 06 .151 00 -.0059
023232	60	51	.10715968 06 .151 00 .0029
023332	60	51	.10716873 06 .151 00 -.0010
023432	60	51	.10717780 06 .151 00 -.0010
023532	60	51	.10718688 06 .151 00 -.0313
023632	60	51	.10719597 06 .151 00 -.0078
023932	60	51	.10722333 06 .151 00 .0059
024032	60	51	.10723247 06 .151 00 -.0195
024132	60	51	.10724162 06 .151 00 -.0215
024232	60	51	.10725079 06 .151 00 .0137
024332	60	51	.10725996 06 .151 00 .0039
024432	60	51	.10726915 06 .151 00 .0010
024532	60	51	.10727835 06 .151 00 -.0127
024632	60	51	.10728755 06 .151 00 .0127
024732	60	51	.10729677 06 .151 00 .0117
024832	60	51	.10730600 06 .151 00 -.0342
024932	60	51	.10731524 06 .151 00 -.0049
025032	60	51	.10732448 06 .151 00 -.0029
025132	60	51	.10733374 06 .151 00 .0088

STATION NUMBER 51 64/07/30 ITERATION NUMBER 2 PASS NUMBER 07/302

FREQUENCY 8224.7

TIME	TC	Q	CC3
025232	60	51	.10734301 06 .151 00 -.0068
025332	60	51	.10735228 06 .151 00 .0010
025432	60	51	.10736156 06 .151 00 .0010
025532	60	51	.10737086 06 .151 00 -.0244
025632	60	51	.10738016 06 .151 00 .0264
025732	60	51	.10738946 06 .151 00 .0010
025832	60	51	.10739878 06 .151 00 .0205
025932	60	51	.10740810 06 .152 00 .0137
030032	60	51	.10741743 06 .152 00 -.0166
030132	60	51	.10742677 06 .152 00 -.0195
030232	60	51	.10743611 06 .152 00 .0029
030332	60	51	.10744546 06 .152 00 -.0146
030432	60	51	.10745482 06 .152 00 -.0039
030532	60	51	.10746418 06 .152 00 .0000
030632	60	51	.10747355 06 .152 00 .0146
030732	60	51	.10748293 06 .152 00 -.0098
030832	60	51	.10749230 06 .152 00 -.0049
030932	60	51	.10750169 06 .152 00 -.0078
031032	60	51	.10751108 06 .152 00 .0039
031132	60	51	.10752047 06 .152 00 .0088
031232	60	51	.10752987 06 .152 00 -.0059
031332	60	51	.10753928 06 .152 00 .0078
031432	60	51	.10754868 06 .152 00 .0010
031532	60	51	.10755809 06 .152 00 .0068
031632	60	51	.10756751 06 .152 00 -.0244
031732	60	51	.10757692 06 .152 00 .0088
031832	60	51	.10758634 06 .152 00 .0225
031932	60	51	.10759577 06 .152 00 -.0010
032032	60	51	.10760519 06 .152 00 -.0273
032132	60	51	.10761462 06 .152 00 -.0215
032232	60	51	.10762405 06 .152 00 .0156
032332	60	51	.10763348 06 .152 00 -.0176
032432	60	51	.10764292 06 .152 00 .0156
032532	60	51	.10765235 06 .152 00 -.0029
032632	60	51	.10766179 06 .152 00 .0283
032732	60	51	.10767123 06 .152 00 -.0098
033132	60	51	.10770898 06 .152 00 .0029
033432	60	51	.10773729 06 .153 00 -.0098
033532	60	51	.10774673 06 .153 00 .0205
033632	60	51	.10775616 06 .153 00 .0010
033732	60	51	.10776560 06 .153 00 -.0156
033832	60	51	.10777503 06 .153 00 -.0137
033932	60	51	.10778446 06 .153 00 -.0117
034032	60	51	.10779389 06 .153 00 -.0059
034132	60	51	.10780331 06 .153 00 .0020
034232	60	51	.10781274 06 .153 00 .0127
034332	60	51	.10782216 06 .153 00 -.0088
034432	60	51	.10783157 06 .153 00 -.0098
034532	60	51	.10784099 06 .153 00 .0098
034632	60	51	.10785040 06 .153 00 -.0020
034732	60	51	.10785981 06 .153 00 -.0244
034832	60	51	.10786921 06 .153 00 .0049
034932	60	51	.10787861 06 .153 00 -.0098
035032	60	51	.10788800 06 .153 00 .0127
035132	60	51	.10789739 06 .153 00 .0225
035232	60	51	.10790678 06 .153 00 .0049
035332	60	51	.10791616 06 .153 00 -.0264
035432	60	51	.10792553 06 .153 00 -.0166
035532	60	51	.10793490 06 .153 00 .0137
035632	60	51	.10794427 06 .153 00 -.0156
035732	60	51	.10795362 06 .153 00 -.0059
035832	60	51	.10796297 06 .153 00 .0098
040132	60	51	.10799099 06 .153 00 .0137
040232	60	51	.10800031 06 .153 00 -.0098
040332	60	51	.10800962 06 .153 00 .0078
040732	60	51	.10804681 06 .154 00 .0215
041032	60	51	.10807461 06 .154 00 -.0127
041132	60	51	.10808386 06 .154 00 -.0107
041232	60	51	.10809310 06 .154 00 .0166
041332	60	51	.10810233 06 .154 00 -.0293
041432	60	51	.10811155 06 .154 00 .0176
041532	60	51	.10812076 06 .154 00 -.0078
041632	60	51	.10812996 06 .154 00 .0088
041732	60	51	.10813915 06 .154 00 -.0127
041832	60	51	.10814832 06 .154 00 .0088
041932	60	51	.10815749 06 .154 00 .0264
042032	60	51	.10816665 06 .154 00 .0039
042132	60	51	.10817579 06 .154 00 -.0068
042232	60	51	.10818492 06 .154 00 -.0391
042332	60	51	.10819404 06 .154 00 .0244
042432	60	51	.10820315 06 .154 00 -.0010
042532	60	51	.10821225 06 .154 00 -.0303
042632	60	51	.10822133 06 .154 00 .0039
042732	60	51	.10823040 06 .154 00 -.0166
042832	60	51	.10823946 06 .154 00 .0088
042932	60	51	.10824850 06 .154 00 -.0010
043032	60	51	.10825753 06 .154 00 .0020
043132	60	51	.10826655 06 .154 00 .0020
043232	60	51	.10827555 06 .154 00 -.0010
043332	60	51	.10828454 06 .154 00 -.0068
043432	60	51	.10829351 06 .155 00 .0029
043532	60	51	.10830247 06 .155 00 .0088
043632	60	51	.10831142 06 .155 00 -.0029
043732	60	51	.10832035 06 .155 00 -.0156
044032	60	51	.10834704 06 .155 00 .0039
044132	60	51	.10835591 06 .155 00 -.0146
044232	60	51	.10836477 06 .155 00 .0176
044332	60	51	.10837360 06 .155 00 -.0010
044432	60	51	.10838242 06 .155 00 -.0039
044532	60	51	.10839122 06 .155 00 .0117
044632	60	51	.10840001 06 .155 00 -.0059
044732	60	51	.10840877 06 .155 00 -.0068
044832	60	51	.10841752 06 .155 00 -.0244
045132	60	51	.10844367 06 .155 00 .0137

STATION NUMBER 51 64/07/30 ITERATION NUMBER 2 PASS NUMBER 07/302

FREQUENCY 8224.7

TIME	TC	Q	CC3	
045232	60	51	.10845235 06 .155 00	-.0303
045332	60	51	.10846101 06 .155 00	-.0068
045432	60	51	.10846965 06 .155 00	-.0156
045532	60	51	.10847827 06 .155 00	.0127
045632	60	51	.10850402 06 .155 00	.0098
045932	60	51	.10851257 06 .155 00	-.0352
050032	60	51	.10852109 06 .155 00	.0068
050132	60	51	.10852960 06 .155 00	.0020
050232	60	51	.10853808 06 .155 00	-.0322
050332	60	51	.10854654 06 .156 00	.0205
050432	60	51	.10855499 06 .156 00	-.0234
050532	60	51	.10856341 06 .156 00	-.0117
050632	60	51	.10857181 06 .156 00	-.0117
050732	60	51	.10858019 06 .156 00	.0244
050832	60	51	.10858855 06 .156 00	.0166
050932	60	51	.10859689 06 .156 00	-.0195
051032	60	51	.10860520 06 .156 00	-.0176
051132	60	51	.10861349 06 .156 00	.0244
051232	60	51	.10862176 06 .156 00	-.0293
051332	60	51	.10863001 06 .156 00	.0254
051432	60	51	.10863823 06 .156 00	-.0166
051532	60	51	.10864643 06 .156 00	-.0010
051632	60	51	.10865461 06 .156 00	-.0117
051732	60	51	.10866276 06 .156 00	.0176
051832	60	51	.10867090 06 .156 00	.0029
051932	60	51	.10867900 06 .156 00	-.0039
052032	60	51	.10868709 06 .156 00	.0127
052132	60	51	.10869515 06 .156 00	-.0137
052232	60	51	.10870318 06 .156 00	-.0146
052332	60	51	.10871119 06 .156 00	.0088
052432	60	51	.10871917 06 .156 00	-.0098
052532	60	51	.10872713 06 .156 00	-.0029
052632	60	51	.10873507 06 .156 00	-.0049
052732	60	51	.10874298 06 .156 00	.0020
052832	60	51	.10875086 06 .156 00	.0176
053232	60	51	.10878214 06 .157 00	-.0098
053332	60	51	.10878990 06 .157 00	.0039
053432	60	51	.10879762 06 .157 00	.0273
053732	60	51	.10882064 06 .157 00	-.0078
053832	60	51	.10882826 06 .157 00	-.0264
054232	60	51	.10885845 06 .157 00	-.0029
054332	60	51	.10886593 06 .157 00	.0186
054432	60	51	.10887338 06 .157 00	-.0137
054532	60	51	.10888080 06 .157 00	-.0010
054632	60	51	.10888819 06 .157 00	.0234
054732	60	51	.10889556 06 .157 00	-.0059
054832	60	51	.10890289 06 .157 00	.0107
054932	60	51	.10891019 06 .157 00	.0068
055032	60	51	.10891747 06 .157 00	-.0342
055632	60	51	.10896048 06 .157 00	-.0313
055732	60	51	.10896754 06 .157 00	.0068
055832	60	51	.10897457 06 .157 00	.0098
055932	60	51	.10898157 06 .158 00	-.0059
060032	60	51	.10898854 06 .158 00	-.0078
060132	60	51	.10899548 06 .158 00	.0049
060232	60	51	.10900238 06 .158 00	.0166
060332	60	51	.10900926 06 .158 00	-.0059
060432	60	51	.10901610 06 .158 00	.0029
060532	60	51	.10902290 06 .158 00	-.0059
060632	60	51	.10902968 06 .158 00	.0000
060732	60	51	.10903643 06 .158 00	.0225
060832	60	51	.10904314 06 .158 00	-.0205
060932	60	51	.10904981 06 .158 00	-.0156
061032	60	51	.10905646 06 .158 00	.0215
061132	60	51	.10906307 06 .158 00	-.0059
061232	60	51	.10906965 06 .158 00	.0146
061332	60	51	.10907620 06 .158 00	-.0137
061432	60	51	.10908271 06 .158 00	-.0078
061532	60	51	.10908918 06 .158 00	.0146
061632	60	51	.10909563 06 .158 00	-.0127
061732	60	51	.10910204 06 .158 00	.0117
061832	60	51	.10910841 06 .158 00	.0039
061932	60	51	.10911475 06 .158 00	-.0029
062032	60	51	.10912106 06 .158 00	-.0088
062132	60	51	.10912733 06 .158 00	.0205
062232	60	51	.10913357 06 .158 00	-.0156
062332	60	51	.10913977 06 .158 00	.0000
062432	60	51	.10914593 06 .158 00	.0010
062532	60	51	.10915206 06 .158 00	-.0127
062632	60	51	.10915816 06 .159 00	-.0078
062732	60	51	.10916422 06 .159 00	.0000
062832	60	51	.10917024 06 .159 00	-.0059
062932	60	51	.10917622 06 .159 00	-.0098
063032	60	51	.10918218 06 .159 00	.0059
063132	60	51	.10918809 06 .159 00	-.0078
063232	60	51	.10919397 06 .159 00	.0137
063332	60	51	.10919981 06 .159 00	.0059
063432	60	51	.10920561 06 .159 00	.0186
063532	60	51	.10921138 06 .159 00	-.0166
063632	60	51	.10921711 06 .159 00	-.0137
063732	60	51	.10922281 06 .159 00	-.0068
063832	60	51	.10922846 06 .159 00	.0195
063932	60	51	.10923408 06 .159 00	.0010
064032	60	51	.10923966 06 .159 00	.0029
064132	60	51	.10924520 06 .159 00	-.0068
064232	60	51	.10925071 06 .159 00	.0039
064332	60	51	.10925618 06 .159 00	-.0127
064432	60	51	.10926161 06 .159 00	-.0088
064532	60	51	.10926700 06 .159 00	.0010
064632	60	51	.10927235 06 .159 00	-.0020

STATION NUMBER 51 64/07/30 ITERATION NUMBER 2 PASS NUMBER 07/312

FREQUENCY 8168.0

TIME	TC	Q	CC3	
234432	60	51	.10344972 06 .187 00	-.0020
234932	60	51	.10347554 06 .187 00	.0068
235032	60	51	.10348084 06 .187 00	-.0078
235132	60	51	.10348618 06 .187 00	-.0166
235232	60	51	.10349157 06 .187 00	-.0020
235332	60	51	.10349700 06 .187 00	-.0313
235432	60	51	.10350247 06 .187 00	.0117
235532	60	51	.10350799 06 .187 00	-.0049
235632	60	51	.10351355 06 .187 00	.0020
235732	60	51	.10351915 06 .187 00	-.0176
235832	60	51	.10352480 06 .187 00	.0029
235932	60	51	.10353049 06 .187 00	-.0215

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000032	60	51	.10353622 06 .187 00	.0293
000132	60	51	.10354200 06 .187 00	-.0137
000232	60	51	.10354781 06 .187 00	-.0146
000332	60	51	.10355367 06 .187 00	.0078
000432	60	51	.10355958 06 .187 00	-.0117
000532	60	51	.10356552 06 .187 00	-.0234
000632	60	51	.10357151 06 .187 00	.0225
000732	60	51	.10357754 06 .187 00	-.0244
000832	60	51	.10358361 06 .187 00	-.0127
000932	60	51	.10358973 06 .187 00	.0059
001032	60	51	.10359588 06 .187 00	-.0146
001132	60	51	.10360208 06 .187 00	.0049
001232	60	51	.10360832 06 .187 00	.0166
001532	60	51	.10362728 06 .187 00	.0049
001632	60	51	.10363368 06 .187 00	-.0146
001732	60	51	.10364012 06 .187 00	.0088
001832	60	51	.10364661 06 .187 00	.0088
001932	60	51	.10365313 06 .187 00	-.0156
002032	60	51	.10365970 06 .187 00	-.0137
002132	60	51	.10366630 06 .187 00	-.0020
002232	60	51	.10367295 06 .187 00	-.0303
002332	60	51	.10367963 06 .187 00	.0020
002932	60	51	.10372057 06 .187 00	-.0039
003032	60	51	.10372753 06 .187 00	-.0137
003332	60	51	.10374864 06 .187 00	.0059
003432	60	51	.10375576 06 .187 00	-.0078
003532	60	51	.10376291 06 .187 00	-.0273
003632	60	51	.10377010 06 .187 00	.0156
003732	60	51	.10377733 06 .187 00	-.0127
003832	60	51	.10378459 06 .187 00	-.0117
003932	60	51	.10379190 06 .187 00	.0010
004032	60	51	.10379924 06 .187 00	.0107
004132	60	51	.10380662 06 .187 00	-.0176
004232	60	51	.10381403 06 .187 00	-.0166
004332	60	51	.10382148 06 .187 00	-.0029
004432	60	51	.10382897 06 .187 00	-.0254
004532	60	51	.10383650 06 .187 00	.0000
004632	60	51	.10384406 06 .188 00	.0049
004732	60	51	.10385166 06 .188 00	-.0107
004832	60	51	.10385929 06 .188 00	-.0117
004932	60	51	.10386696 06 .188 00	.0010
005032	60	51	.10387467 06 .188 00	.0117
005132	60	51	.10388241 06 .188 00	.0029
005232	60	51	.10389019 06 .188 00	-.0078
005332	60	51	.10389800 06 .188 00	-.0205
005432	60	51	.10390585 06 .188 00	-.0010
005532	60	51	.10391373 06 .188 00	.0166
005632	60	51	.10392165 06 .188 00	-.0342
005732	60	51	.10392960 06 .188 00	-.0029
005832	60	51	.10393759 06 .188 00	-.0059
005932	60	51	.10394561 06 .188 00	-.0273
010032	60	51	.10395366 06 .188 00	.0176
010132	60	51	.10396175 06 .188 00	-.0225
010232	60	51	.10396988 06 .188 00	.0059
010532	60	51	.10399445 06 .188 00	.0186
010632	60	51	.10400270 06 .188 00	-.0205
010732	60	51	.10401099 06 .188 00	-.0098
010832	60	51	.10401931 06 .188 00	.0020
010932	60	51	.10402767 06 .188 00	-.0029
011032	60	51	.10403606 06 .188 00	-.0225
011132	60	51	.10404447 06 .188 00	-.0088
011232	60	51	.10405293 06 .188 00	.0068
011332	60	51	.10406141 06 .188 00	-.0098
011432	60	51	.10406992 06 .188 00	-.0078
011532	60	51	.10407847 06 .188 00	-.0205
011632	60	51	.10408705 06 .188 00	.0352
011732	60	51	.10409566 06 .188 00	.0098
011832	60	51	.10410430 06 .188 00	-.0127
011932	60	51	.10411297 06 .188 00	-.0010
012432	60	51	.10415677 06 .188 00	-.0078
012532	60	51	.10416563 06 .188 00	.0068
012632	60	51	.10417451 06 .188 00	-.0068
012732	60	51	.10418341 06 .188 00	-.0166
012832	60	51	.10419236 06 .188 00	-.0059
012932	60	51	.10420132 06 .188 00	.0088
013032	60	51	.10421032 06 .188 00	-.0205
013332	60	51	.10423748 06 .188 00	-.0156
013432	60	51	.10424659 06 .188 00	.0078
013532	60	51	.10425573 06 .188 00	-.0137
013632	60	51	.10426489 06 .188 00	-.0117
013732	60	51	.10427409 06 .188 00	.0127
013832	60	51	.10428331 06 .188 00	-.0068
013932	60	51	.10429255 06 .188 00	-.0039
014032	60	51	.10430183 06 .188 00	-.0117
014132	60	51	.10431113 06 .188 00	.0215
014232	60	51	.10432045 06 .188 00	-.0049
014332	60	51	.10432981 06 .188 00	-.0078
014432	60	51	.10433919 06 .188 00	.0127
014532	60	51	.10434859 06 .188 00	-.0078

STATION NUMBER 51 64/07/31 ITERATION NUMBER 2 PASS NUMBER 07/312

FREQUENCY 8168.0

TIME	TC	Q	CC3	
014632	60	51	.10435802 06 .188 00	-.0049
014732	60	51	.10436748 06 .188 00	-.0117
014832	60	51	.10437696 06 .188 00	.0078
014932	60	51	.10438646 06 .188 00	-.0156
015032	60	51	.10439599 06 .188 00	-.0293
015132	60	51	.10440555 06 .188 00	.0156
015232	60	51	.10441513 06 .188 00	.0020
015332	60	51	.10442473 06 .188 00	-.0029
015432	60	51	.10443436 06 .188 00	-.0137
015532	60	51	.10444402 06 .188 00	.0010
015632	60	51	.10445369 06 .188 00	.0078
015732	60	51	.10446339 06 .188 00	-.0078
015832	60	51	.10447311 06 .188 00	-.0127
015932	60	51	.10448286 06 .188 00	-.0088
020032	60	51	.10449263 06 .188 00	.0068
020132	60	51	.10450242 06 .188 00	-.0010
020232	60	51	.10451223 06 .188 00	.0020
020332	60	51	.10452206 06 .188 00	-.0156
020432	60	51	.10453192 06 .188 00	.0098
020532	60	51	.10454180 06 .188 00	-.0186
020632	60	51	.10455170 06 .188 00	-.0195
020732	60	51	.10456162 06 .188 00	-.0078
020832	60	51	.10457157 06 .189 00	-.0010
020932	60	51	.10458153 06 .189 00	.0186
021032	60	51	.10459152 06 .189 00	.0000
021132	60	51	.10460152 06 .189 00	-.0215
021232	60	51	.10461155 06 .189 00	.0029
021332	60	51	.10462159 06 .189 00	-.0098
021432	60	51	.10463166 06 .189 00	.0234
021532	60	51	.10464174 06 .189 00	-.0283
021632	60	51	.10465185 06 .189 00	-.0156
021732	60	51	.10466197 06 .189 00	-.0068
021832	60	51	.10467212 06 .189 00	.0000
021932	60	51	.10468228 06 .189 00	.0059
022032	60	51	.10469246 06 .189 00	-.0254
022132	60	51	.10470266 06 .189 00	.0088
022232	60	51	.10471287 06 .189 00	-.0078
022332	60	51	.10472311 06 .189 00	-.0098
022432	60	51	.10473336 06 .189 00	-.0127
022532	60	51	.10474363 06 .189 00	.0000
022632	60	51	.10475392 06 .189 00	-.0049
022732	60	51	.10476422 06 .189 00	-.0098
023032	60	51	.10479524 06 .189 00	-.0078
023132	60	51	.10480561 06 .189 00	-.0117
023232	60	51	.10481600 06 .189 00	.0010
023332	60	51	.10482640 06 .189 00	-.0195
023432	60	51	.10483682 06 .189 00	-.0039
023532	60	51	.10484725 06 .189 00	.0117
023632	60	51	.10485770 06 .189 00	-.0215
023732	60	51	.10486817 06 .189 00	-.0020
023832	60	51	.10487865 06 .189 00	-.0137
023932	60	51	.10488914 06 .189 00	.0098
024032	60	51	.10489965 06 .189 00	.0020
024132	60	51	.10491017 06 .189 00	-.0029
024232	60	51	.10492070 06 .189 00	.0107
024332	60	51	.10493125 06 .189 00	-.0215
024432	60	51	.10494182 06 .189 00	.0000
024532	60	51	.10495239 06 .189 00	-.0098
024632	60	51	.10496298 06 .189 00	.0010
024732	60	51	.10497358 06 .189 00	.0010
024832	60	51	.10498420 06 .189 00	-.0137
025132	60	51	.10501611 06 .189 00	.0049
025232	60	51	.10502677 06 .189 00	-.0234
025532	60	51	.10505882 06 .189 00	.0068
025632	60	51	.10506953 06 .190 00	.0000
025732	60	51	.10508025 06 .190 00	.0000
025832	60	51	.10509098 06 .190 00	-.0107
030132	60	51	.10512322 06 .190 00	.0146
030232	60	51	.10513398 06 .190 00	-.0176
030332	60	51	.10514476 06 .190 00	.0078
030432	60	51	.10515554 06 .190 00	-.0264
030532	60	51	.10516634 06 .190 00	.0137
030632	60	51	.10517714 06 .190 00	.0127
030732	60	51	.10518795 06 .190 00	-.0146
030832	60	51	.10519876 06 .190 00	-.0322
030932	60	51	.10520959 06 .190 00	.0254
031032	60	51	.10522042 06 .190 00	-.0410
031132	60	51	.10523126 06 .190 00	-.0146
031732	60	51	.10529645 06 .190 00	-.0020
032032	60	51	.10532912 06 .190 00	.0068
032132	60	51	.10534003 06 .190 00	-.0283
032232	60	51	.10535094 06 .190 00	.0303
032332	60	51	.10536185 06 .190 00	-.0146
032432	60	51	.10537276 06 .190 00	.0029
032532	60	51	.10538368 06 .190 00	-.0186
032632	60	51	.10539461 06 .190 00	.0234
032732	60	51	.10540554 06 .190 00	-.0049
032832	60	51	.10541647 06 .190 00	-.0039
032932	60	51	.10542741 06 .190 00	.0107
033032	60	51	.10543834 06 .190 00	-.0107
033132	60	51	.10544928 06 .190 00	-.0020
033432	60	51	.10548212 06 .190 00	.0088
033532	60	51	.10549307 06 .190 00	-.0078
033632	60	51	.10550403 06 .190 00	.0068
033732	60	51	.10551498 06 .190 00	-.0146
033832	60	51	.10552594 06 .190 00	-.0039
034132	60	51	.10555881 06 .191 00	-.0078
034232	60	51	.10556976 06 .191 00	.0010
034332	60	51	.10558072 06 .191 00	.0078
034432	60	51	.10559168 06 .191 00	.0000
034532	60	51	.10560264 06 .191 00	-.0078
034632	60	51	.10561360 06 .191 00	-.0156
034732	60	51	.10562456 06 .191 00	-.0059
034832	60	51	.10563551 06 .191 00	.0049

STATION NUMBER 51 64/07/31 ITERATION NUMBER 2 PASS NUMBER 07/312

FREQUENCY 8168.0

TIME	TC	Q	CC3	
034932	60	51	.10564847 06 .191 00	.0156
035032	60	51	.10565742 06 .191 00	.0117
035132	60	51	.10566837 06 .191 00	-.0234
035232	60	51	.10567932 06 .191 00	-.0234
035332	60	51	.10571216 06 .191 00	.0059
035832	60	51	.10574497 06 .191 00	-.0078
035932	60	51	.10575590 06 .191 00	.0117
040232	60	51	.10578867 06 .191 00	-.0098
040532	60	51	.10582141 06 .191 00	-.0088
041432	60	51	.10591932 06 .191 00	-.0010
041532	60	51	.10593016 06 .191 00	-.0146
041632	60	51	.10594100 06 .191 00	-.0215
041732	60	51	.10595184 06 .191 00	.0293
041832	60	51	.10596266 06 .191 00	.0039
042132	60	51	.10599509 06 .192 00	-.0234
042232	60	51	.10600588 06 .192 00	.0166
042332	60	51	.10601667 06 .192 00	-.0332
042432	60	51	.10602744 06 .192 00	.0244
042532	60	51	.10603821 06 .192 00	.0244
042632	60	51	.10604896 06 .192 00	-.0322
042732	60	51	.10605971 06 .192 00	.0205
042832	60	51	.10607045 06 .192 00	-.0166
042932	60	51	.10608118 06 .192 00	.0225
043032	60	51	.10609189 06 .192 00	.0049
043132	60	51	.10610260 06 .192 00	-.0186
043232	60	51	.10611330 06 .192 00	.0010
043332	60	51	.10612398 06 .192 00	-.0020
043432	60	51	.10613466 06 .192 00	-.0098
043532	60	51	.10614532 06 .192 00	-.0400
043832	60	51	.10617724 06 .192 00	-.0283
043932	60	51	.10618786 06 .192 00	-.0117
044032	60	51	.10619846 06 .192 00	-.0166
044132	60	51	.10620906 06 .192 00	-.0078
044232	60	51	.10621964 06 .192 00	.0127
044332	60	51	.10623020 06 .192 00	-.0371
044432	60	51	.10624076 06 .192 00	-.0234
044532	60	51	.10625129 06 .192 00	.0371
044632	60	51	.10626182 06 .192 00	-.0234
044732	60	51	.10627233 06 .192 00	-.0020
045032	60	51	.10630379 06 .192 00	.0273
045332	60	51	.10633511 06 .192 00	.0205
045432	60	51	.10634552 06 .192 00	-.0068
045532	60	51	.10635592 06 .192 00	.0137
045832	60	51	.10638701 06 .193 00	.0215
045932	60	51	.10639734 06 .193 00	.0059
050032	60	51	.10640766 06 .193 00	-.0068
050132	60	51	.10641796 06 .193 00	-.0088
050232	60	51	.10642824 06 .193 00	-.0088
050332	60	51	.10643851 06 .193 00	.0107
050432	60	51	.10644875 06 .193 00	.0283
050532	60	51	.10645898 06 .193 00	-.0029
050632	60	51	.10646920 06 .193 00	.0166
050732	60	51	.10647939 06 .193 00	.0049
050832	60	51	.10648957 06 .193 00	-.0059
050932	60	51	.10649973 06 .193 00	.0010
051232	60	51	.10653010 06 .193 00	.0332
051332	60	51	.10654018 06 .193 00	-.0186
052032	60	51	.10661023 06 .193 00	-.0176
052132	60	51	.10662016 06 .193 00	-.0273
052232	60	51	.10663007 06 .193 00	.0166
052332	60	51	.10663995 06 .193 00	-.0186
052432	60	51	.10664981 06 .193 00	.0010
052532	60	51	.10665966 06 .193 00	.0078
052632	60	51	.10666948 06 .193 00	-.0146
052732	60	51	.10667928 06 .193 00	-.0303
052832	60	51	.10668906 06 .193 00	-.0088
052932	60	51	.10669881 06 .193 00	-.0156

FREQUENCY 8200.0

054232	60	51	.10682358 06 .194 00	.0381
054332	60	51	.10683301 06 .194 00	-.0088
054432	60	51	.10684242 06 .194 00	.0176
054532	60	51	.10685180 06 .194 00	.0205
054632	60	51	.10686115 06 .194 00	.0137
054732	60	51	.10687048 06 .194 00	-.0010
054832	60	51	.10687979 06 .194 00	.0273
054932	60	51	.10688907 06 .194 00	-.0029
055232	60	51	.10691676 06 .194 00	.0098
055332	60	51	.10692593 06 .194 00	-.0010
055432	60	51	.10693508 06 .194 00	.0156
055532	60	51	.10694421 06 .194 00	.0068
055632	60	51	.10695331 06 .194 00	.0098
055732	60	51	.10696238 06 .194 00	.0059
055832	60	51	.10697142 06 .194 00	.0117
055932	60	51	.10698044 06 .194 00	-.0059
060032	60	51	.10698943 06 .194 00	.0049
060132	60	51	.10699839 06 .194 00	.0098
060232	60	51	.10700732 06 .194 00	-.0088
060332	60	51	.10701623 06 .194 00	.0352
060432	60	51	.10702511 06 .194 00	.0049
060532	60	51	.10703396 06 .195 00	.0205
060632	60	51	.10704278 06 .195 00	-.0186
060732	60	51	.10705158 06 .195 00	.0205
060832	60	51	.10706034 06 .195 00	.0205
060932	60	51	.10706908 06 .195 00	.0000
061032	60	51	.10707779 06 .195 00	-.0088
061132	60	51	.10708647 06 .195 00	.0283
061232	60	51	.10709512 06 .195 00	-.0225
061332	60	51	.10710374 06 .195 00	.0234
061432	60	51	.10711233 06 .195 00	-.0020
061532	60	51	.10712090 06 .195 00	.0010
061632	60	51	.10712943 06 .195 00	.0020
061732	60	51	.10713793 06 .195 00	-.0010

STATION NUMBER 51 64/07/31 ITERATION NUMBER 2 PASS NUMBER 07/312

FREQUENCY 8200.0

TIME	TC	Q	CC3	
061832	60	51	.10714641 06 .195 00	.0264
061932	60	51	.10715485 06 .195 00	.0166
062032	60	51	.10716326 06 .195 00	-.0127
062132	60	51	.10717164 06 .195 00	.0049
062232	60	51	.10717999 06 .195 00	-.0039
062332	60	51	.10718832 06 .195 00	-.0010
062432	60	51	.10719661 06 .195 00	.0088
062532	60	51	.10720487 06 .195 00	-.0176
062632	60	51	.10721309 06 .195 00	.0049
062732	60	51	.10722129 06 .195 00	-.0088
062832	60	51	.10722946 06 .195 00	.0078
062932	60	51	.10723759 06 .195 00	-.0088
063032	60	51	.10724569 06 .195 00	.0049
063132	60	51	.10725376 06 .195 00	-.0156
063232	60	51	.10726180 06 .195 00	.0117
063332	60	51	.10726981 06 .195 00	-.0117
063432	60	51	.10727779 06 .195 00	-.0029
063532	60	51	.10728573 06 .195 00	-.0293
063632	60	51	.10729364 06 .195 00	.0107
063932	60	51	.10731717 06 .196 00	-.0244
064032	60	51	.10732495 06 .196 00	-.0039
064132	60	51	.10733270 06 .196 00	-.0342
064232	60	51	.10734041 06 .196 00	.0029
064332	60	51	.10734809 06 .196 00	-.0107
064432	60	51	.10735574 06 .196 00	-.0244
064532	60	51	.10736335 06 .196 00	.0293
064632	60	51	.10737093 06 .196 00	-.0176
064732	60	51	.10737848 06 .196 00	-.0137
064832	60	51	.10738599 06 .196 00	-.0088
064932	60	51	.10739347 06 .196 00	-.0039
065032	60	51	.10740091 06 .196 00	-.0313
065132	60	51	.10740832 06 .196 00	.0254
065432	60	51	.10743035 06 .196 00	.0342
065532	60	51	.10743762 06 .196 00	-.0215
065632	60	51	.10744486 06 .196 00	-.0078
065732	60	51	.10745206 06 .196 00	-.0117
065832	60	51	.10745923 06 .196 00	.0205
070132	60	51	.10748052 06 .196 00	.0254
070232	60	51	.10748755 06 .196 00	-.0186
070332	60	51	.10749454 06 .196 00	-.0107
070432	60	51	.10750150 06 .196 00	-.0186
070532	60	51	.10750842 06 .196 00	-.0059
070632	60	51	.10751531 06 .196 00	.0088
070732	60	51	.10752216 06 .197 00	.0078
070832	60	51	.10752897 06 .197 00	-.0059
070932	60	51	.10753575 06 .197 00	.0166
071032	60	51	.10754249 06 .197 00	-.0264
071132	60	51	.10754920 06 .197 00	.0010
071232	60	51	.10755587 06 .197 00	.0146
071332	60	51	.10756250 06 .197 00	-.0361
071432	60	51	.10756910 06 .197 00	.0000

DATA STATISTICS STATION 5 ITERATION 2

PASS	DATA TYPE	BEGINNING TIME	END TIME	NUMBER OF POINTS	STD DEV	RMS	FIRST MOMENT	SECOND MOMENT
07/302	CC3	7/30-015232	7/30-064632	256	.140-01	.141-01	-.156-02	.199-03
07/312	CC3	7/30-234432	7/31-071432	357	.156-01	.158-01	-.265-02	.249-03

INPUT COVARIANCE MATRIX OF ESTIMATED PARAMETERS ITERATION NUMBER 2

	X	Y	Z	DX	DY	DZ	KE	RE	G
X	.30722399 00	-.98625403 00	.11672552 01	.19744463-05	-.57214722-05	.12780917-04	-.11636031 00	.13981280-01	-.78391934-02
Y	-.98625403 00	.35758012 01	-.35103058 01	-.65204328-05	.22985862-04	-.46856048-04	.12219744 01	-.52346163-01	.10114864-01
Z	.11672552 01	-.55103058 01	.13177476 02	.11420648-04	-.51615141-04	.91980971-04	-.37734081 01	.10493568 00	.57594169-01
DX	.19744463-05	-.65204328-05	.11420648-04	.31567158-10	-.92784246-10	.32740374-09	-.61510009-09	.71929342-05	-.64102732-06
DY	-.57214722-05	.22985862-04	-.51615141-04	-.92784246-10	.32740374-09	-.61510009-09	.71929342-05	-.64102732-06	.20023810-06
DZ	.12780917-04	-.46856048-04	.91980971-04	.18275381-09	-.61510009-09	.12088693-08	-.68541985-05	.12394816-05	.10309564-06
KE	-.11636031 00	.12219744 01	-.37734081 01	.62754984-06	.71929342-05	-.68541985-05	.23419515 01	-.11571507-01	.65541669-02
RE	.13981280-01	-.52346163-01	.10493568 00	.19005509-06	-.64102732-06	.12394816-05	-.11571507-01	.13125908-02	.97503653-04
G	-.78391934-02	.10114864-01	.57594169-01	-.18949724-06	.20023810-06	.10309564-06	.65541669-02	.97503653-04	.89780880-01
KM	-.60550599-01	.17218261 00	-.91421402-01	-.44096627-06	.88392027-06	-.18678364-05	.14019141-01	-.21764139-02	.44101735-02
RI(01)	.14225842-01	-.16969669-01	.61889157-01	.23250200-07	.86525856-07	.19188069-06	.56797750-01	.21174448-04	-.48810453-03
LO(01)	-.14343778-03	.29830824-03	-.25470015-03	-.20877728-09	.28479728-09	.70968278-09	.59853821-03	.58737314-07	.20788301-04
RI(03)	.20770221-02	-.10864308-01	.33256309-01	.23196464-07	-.11482861-06	.18891136-06	-.95434430-02	.23769043-03	.32240217-04
LA(03)	-.36599490-04	.11747604-03	-.91261365-04	-.18835798-09	.67710610-09	-.17036768-08	.15352399-04	-.15065486-05	.28481707-07
LO(03)	-.29081140-03	.10694123-02	-.19003905-02	-.27790469-08	.91426244-08	-.17932386-07	.31610765-03	-.20252136-04	.29594182-05
RI(04)	.49233137-02	-.22677663-01	.48123525-01	.20256476-07	-.14712887-06	.25414338-06	.19856429-01	.28869519-03	.98582038-04
LA(04)	.43169525-04	.16898449-03	.10622659-02	.23633580-08	-.12172276-08	.92502493-08	-.78497351-04	.25873037-05	.17611564-05
LO(04)	-.30859734-03	.10622659-02	-.16787549-02	-.29922799-08	.92502493-08	-.18889607-07	.15714878-03	-.20542879-04	.43867034-05
RI(05)	.54864675-02	-.16414988-01	.21944612-01	.56449349-07	-.15795213-06	.35499457-06	.57131375-02	.35859197-03	.81466942-04
LO(05)	-.30771112-03	.10769768-02	-.17555282-02	-.27592701-08	.89341856-08	-.18021194-07	.24682402-03	-.19899743-04	.44741727-05

	KM	RI(01)	LO(01)	RI(03)	LA(03)	LO(03)	RI(04)	LA(04)	LO(04)
X	-.60550599-01	.14225842-01	-.14343778-03	.20770221-02	-.36599490-04	-.29081140-03	.49233137-02	.43169525-04	-.30859734-03
Y	.17218261 00	-.16969669-01	.29830824-03	-.10864308-01	.11747604-03	.10694123-02	-.22677663-01	-.16898449-03	.10622654-02
Z	-.91421402-01	.61889157-01	-.25470015-03	.33256309-01	-.91261365-04	-.19003905-02	.48123525-01	.10622659-02	-.16787549-02
DX	-.44096627-06	.23250200-07	-.20877728-09	.23196464-07	-.18835798-09	-.27790469-08	.20256476-07	.23633580-08	-.29922799-08
DY	.88392027-06	.86525856-07	.28479728-09	-.11482861-06	.67710610-09	.91426244-08	-.14712887-06	-.12172276-08	.92502493-08
DZ	-.18678364-05	.19188069-06	.70968278-09	.18891136-06	-.17036768-08	-.17932386-07	.25414338-06	-.23633580-08	-.18889607-07
KE	.14019141-01	.56797750-01	.59853821-03	-.95434430-02	.15352399-04	.31610765-03	-.19856429-01	-.78497351-04	.15714878-03
RE	-.21764139-02	.21174448-04	.58737314-07	.23769043-03	-.15065486-05	-.20252136-04	.28869519-03	.25873037-05	-.20542879-04
G	.44101735-02	-.48810453-03	.20788301-04	.32240217-04	-.28481707-07	.29594182-05	.98582038-04	.17611564-05	.43867034-05
KM	.27917855-01	-.67555274-03	.49062728-04	.61432014-04	-.46260878-05	.50147331-04	-.42503281-03	-.27749806-05	.55929868-04
RI(01)	-.67555274-03	.10247617 00	-.33324110-03	.32298386-03	.88468032-06	.11258772-05	.29005305-02	.42267872-05	-.10025192-04
LO(01)	.49062728-04	-.33324110-03	.22071013-05	-.15228585-05	.23397614-07	.84022531-07	.17008968-04	-.47299767-06	.86429536-07
RI(03)	.61432014-04	.32298386-03	-.15228585-05	.33786216-02	.41483197-04	.37802681-05	.11476978-03	.47930495-06	-.36762266-05
LA(03)	-.46260878-05	.88468032-06	.23397614-07	.41483197-04	.54581991-06	.33270169-07	-.62481485-06	-.73072263-08	.30198977-07
LO(03)	.50147331-04	.11258772-05	.84022531-07	-.37802681-05	.33270169-07	.38959708-06	-.58318610-05	-.46311178-07	.37217489-06
RI(04)	-.42503281-03	.29005305-02	.17008968-04	.11476978-03	-.62481485-06	-.58318610-05	.33338294-02	-.34490378-04	.74193808-05
LA(04)	-.27749806-05	.42267872-05	-.47299767-06	.47930495-06	-.73072263-08	-.46311178-07	-.34490378-04	.59845036-06	-.45458953-07
LO(04)	.55929868-04	-.10025192-04	.86429536-07	-.36762266-05	.30198977-07	.37217489-06	-.74193808-05	-.45458953-07	.41362332-06
RI(05)	-.56802807-03	.37927577-02	-.11444848-04	-.61042573-04	-.46679594-06	-.56846392-05	.10708535-03	.18695865-05	-.67077247-05
LO(05)	.53893163-04	-.57702871-05	.10240330-06	-.42332243-05	.28417624-07	.36971597-06	-.50471583-05	-.50459689-07	.37179442-06

	RI(05)	LO(05)
X	.54864675-02	-.30771112-03
Y	-.16414988-01	.10769768-02
Z	.21944612-01	-.17555282-02
DX	.56449349-07	-.27592701-08
DY	-.15795213-06	.89341856-08
DZ	.35499457-06	-.18021194-07
KE	.57131375-02	.24682402-03
RE	.35859197-03	-.19899743-04
G	.81466942-04	.44741727-05
KM	-.56802807-03	.53893163-04
RI(01)	.37927577-02	-.57702871-05
LO(01)	-.11444848-04	.10240330-06
RI(03)	.61042573-04	-.42332243-05
LA(03)	-.46679594-06	.28417624-07
LO(03)	-.56846392-05	.36971597-06
RI(04)	.10708535-03	-.50471583-05
LA(04)	.18695865-05	-.50459689-07
LO(04)	-.67077247-05	.37179442-06
RI(05)	.66937832-03	-.82104760-05
LO(05)	-.82104760-05	.38273119-06

INPUT J MATRIX OF ESTIMATED PARAMETERS ITERATION NUMBER 2

	X	Y	Z	DX	DY	DZ	KE	RE	G
X	.85163665 03	.28502607 03	.64826412 02	-.15885398-02	-.18668031-02	.38218288-02	-.16938576 02	-.42726149 00	-.43705888 00
Y	.28502607 03	.97419429 02	.21780316 02	-.10293284-03	-.15708662-02	.11024262-02	-.59156123 01	-.33349441 00	-.28163180-01
Z	.64826412 02	.21780316 02	.51994829 01	.12290161-03	-.25179789-03	-.50946106-03	-.54718344 00	.43805061-01	-.97082003-01
DX	-.15885398-02	-.10293284-03	.12290161-03	.99902473 02	.18547159-07	-.43641042-07	.19220584-03	.82434707-04	-.71552533-04
DY	-.18668031-02	-.15708662-02	-.25179789-03	.18547159-07	.99902505 02	.11268346-06	-.67230716-04	-.39833532-04	.12679693-03
DZ	.38218288-02	.11024262-02	-.50946106-03	-.43641042-07	.11268346-06	.99902683 02	.58813088-04	.11663531-04	-.29749154-04
KE	-.16938576 02	-.59156123 01	-.54718344 00	.19220584-03	-.67230716-04	.58813088-04	.35176765 01	.47396158 00	-.30384642 00
RE	-.42726149 00	-.33349441 00	.43805061-01	.62434707-04	-.39833532-04	.11663531-04	.47396158 00	.40009784 03	-.57038426-01
G	-.43705888 00	-.28163180-01	-.97082003-01	-.71552533-04	.12679693-03	.29749154-04	-.30384642 00	-.57038426-01	.11149291 02
KM	.18007366 00	.12980468 00	-.15260588-01	-.22135485-04	.12761127-04	-.51729438-05	.17467705 00	-.36444832-01	.21297955-01
RI(01)	-.10782327 03	-.19245117 02	.10622564 02	.58088388-03	-.13701642-02	.30789632-02	-.71318755 01	-.91926836 00	.59659083 00
LO(01)	-.28437181 05	-.10315742 05	-.30037066 04	-.11522820-01	.11327891 00	-.29554281 00	-.20269867 04	-.24135398 03	.18845183 03
RI(03)	-.70891644 03	-.26985570 03	-.52864302 02	.69693921-04	-.35613984-03	.51655930-03	.44339909 02	.88048049 01	-.37021707 01
LA(03)	.52271594 05	.19899459 05	.38980086 04	-.51511596-02	.26291696-01	-.38162788-01	-.32690150 04	-.64895821 03	.27290906 03
LO(03)	.34086107 05	.12611852 05	.25281102 04	-.11077779-02	.11316003-01	-.11257481-01	-.22026153 04	-.47260125 03	.18999539 03
RI(04)	.11831728 03	.52898314 02	.14538103 04	.20028888-02	-.39329205-02	.11454651-01	.39855759 02	.57312676 01	-.14431551 01
LA(04)	-.16824338 05	-.53803270 04	-.14538103 04	.95764393-01	-.74893890-01	.49193035 00	.95451954 03	.18917175 03	-.69491098 02
LO(04)	-.31989982 04	-.13417877 04	.82716845 03	.20130501 00	-.28895548 00	.10977378 01	.54536321 04	.68307578 03	-.51916444 03
RI(05)	-.93882275 01	.11580372 01	-.10983517 02	.84427038-03	-.21964951-02	.51179768-02	-.32077143 02	-.66824017 01	.49952787 01
LO(05)	.15515472 06	.46236359 05	.11420230 05	.70156812-01	-.13883021 00	.40077712 00	-.36505401 04	.48008971 03	-.26731182 03

	KM	RI(01)	LO(01)	RI(03)	LA(03)	LO(03)	RI(04)	LA(04)	LO(04)
X	.18007366 00	-.10782327 03	-.28437181 05	-.70891644 03	.52271594 05	.34086107 05	.11831728 03	-.16824338 05	-.31989982 04
Y	.12980468 00	-.19245117 02	-.10315742 05	-.26985570 03	.19899459 05	.12611852 05	.52898314 02	-.53803270 04	-.13417877 04
Z	-.15260588-01	.10622564 02	-.30037066 04	-.52864302 02	.38980086 04	.25281102 04	.14538103 04	-.14538103 04	.82716845 03
DX	-.22135485-04	.58088388-03	-.11522820-01	.69693921-04	-.51511596-02	-.11077779-02	.20028888-02	.95764393-01	.20130501 00
DY	.12761127-04	-.13701642-02	.11327891 00	-.35613984-03	.26291696-01	.11316003-01	-.39329205-02	-.74893890-01	-.28895548 00
DZ	-.51729438-05	.30789632-02	-.29554281 00	.51655930-03	-.38162788-01	-.11257481-01	.11454651-01	.49193035 00	.10977378 01
KE	.17467705 00	-.71318755 01	-.20269867 04	.44339909 02	-.32690150 04	-.22026153 04	.39855759 02	.95451954 03	.54536321 04
RE	-.36444832-01	-.91926836 00	-.24135398 03	.88048049 01	-.64895821 03	-.47260125 03	.57312676 01	.18917175 03	.68307578 03
G	.21297955-01	.59659083 00	.18845183 03	-.37021707 01	.27290906 03	.18999539 03	-.14431551 01	-.69491098 02	-.51916444 03
KM	.53578897-01	.34664852 00	.91178983 02	-.32749304 01	.24138124 03	.17534560 03	-.21626042 01	-.71151700 02	-.25848354 03
RI(01)	.34664852 00	.74304436 02	.16271992 05	.10387106 02	-.76509416 03	-.64090496 03	-.21371102 03	-.43902879 03	-.15809545 05
LO(01)	.91178983 02	.16271992 05	.44584900 07	.11263179 05	-.83060753 06	-.51771580 06	-.44771042 05	.69709881 06	-.35936073 07
RI(03)	-.32749304 01	.10387106 02	.11263179 05	.19337401 04	-.13495184 06	-.85991383 05	.14181401 03	.21901966 05	.29513988 05
LA(03)	.24138124 03	-.76509416 03	-.83060753 06	-.13495184 06	.11167555 08	.63354071 07	-.10453449 05	-.16148046 07	-.21021726 07
LO(03)	.17534560 03	-.64090496 03	-.51771580 06	-.85991383 05	.63354071 07	.52059057 07	-.73938430 04	-.10766111 07	-.14249735 07
RI(04)	-.21626042 01	-.21371102 03	-.44771042 05	.14181401 03	-.10453449 05	-.73938430 04	.11753717 04	.32043860 05	.94880682 05
LA(04)	-.71151700 02	-.43902879 03	.69709881 06	.21901966 05	-.16148046 07	-.10766111 07	.32043860 05	.98547985 07	.27913303 07
LO(04)	-.25848354 03	-.15809945 05	-.35936073 07	.29513988 05	-.21021726 07	-.14249735 07	.94880682 05	.27913303 07	.14245128 08
RI(05)	.24987148 01	-.47263028 02	.12143414 05	-.12203543 02	.90126955 03	.32313102 03	-.20702050 03	-.75700005 04	-.18564167 05
LO(05)	-.16760579 03	-.11211580 05	-.34050930 07	.48244372 04	-.35561785 06	-.25206016 06	-.56762017 05	-.61964460 07	-.89941672 07

	RI(05)	LO(05)
X	-.93882275 01	.15515472 06
Y	.11580372 01	.46236359 05
Z	-.10983517 02	.11420230 05
DX	.84427038-03	.70156812-01
DY	-.21964951-02	-.13883021 00
DZ	.51179768-02	.40077712 00
KE	-.32077143 02	-.36505401 04
RE	-.66824017 01	.48008971 03
G	.49952787 01	-.26731182 03
KM	.24987148 01	-.16760579 03
RI(01)	-.47263028 02	-.11211580 05
LO(01)	.12143414 05	-.34050930 07
RI(03)	-.12203543 02	.48244372 04
LA(03)	.90126955 03	-.35561785 06
LO(03)	.32313102 03	-.25206016 06
RI(04)	-.20702050 03	-.56762017 05
LA(04)	-.75700005 04	-.61964460 07
LO(04)	-.18564167 05	-.89941672 07
RI(05)	.19995329 04	-.78609341 04
LO(05)	-.78609341 04	.56974344 08

CASE 1 SPACE TRAJECTORIES

EPHEMERIS TAPE IV WITH MARS VELOCITIES. B-8 IS

GME	.39860138 06	J	.16234500-02	H	-.57499999-05	D	.78749999-05	RE	.63781650 04	REM	.63783080 04				
G	.66709998-19	A	.88782497 29	B	.88800499 29	C	.88837498 29	UME	.41780741-02	AU	.14959900 09				
GMM	.49025900 04	GMS	.13271544 12	GMV	.32476952 06	GMA	.42977799 05	GMC	.37918700 08	GMJ	.12671062 09				
EGM	.39860320 06	MGM	.49027779 04	JA	.29200000-02	HA	.00000000 00	DA	.00000000 00	RA	.34170000 04				
ARA	.35670000 01	GB	.39224036 00	MAS	.37410000 03	GB1	.00000000 00	GB2	.00000000 00	SC	.10200000 09				

INJECTION CONDITIONS MOON 2356665063532024000000000 J.D.= 2438605.93608796 JULY 29,1964 10 27 58.000

GEOCENTRIC XO .15667452 06 YO .63041633 05 ZO .80776773 04 DXO .14342616 01 DYO .97257020 00 DZO .28116151 00
CARTESIAN GMC .00000000 00 SGC .00000000 00 TU .37678000 05 GHA .10409373 03 GHU .30667226 03
DATE OF RUN 111464A 000000 EARTH IS THE CENTRAL BODY FOR INTEGRATION COWELL EQUATIONS OF MOTION

0 DAYS 0 HRS. 0 MIN. 0.000 SEC. 2356665063532024000000000 J.D.= 2438605.93608796 JULY 29,1964 10 27 58.000

GEOCENTRIC EQUATORIAL COORDINATES

X	.15667452 06	Y	.63041632 05	Z	.80776772 04	DX	.14342615 01	DY	.97257017 00	DZ	.28116150 00				
R	.16907513 06	DEC	.27383859 01	RA	.21918536 02	V	.17555770 01	PTH	.76231923 02	AZ	.61412209 02				
R	.16907513 06	LAT	.27383859 01	LON	.27782480 03	VE	.12070911 02	PTE	.81207508 01	AZE	.27095862 03				
XS	-.89949617 08	YS	.11227379 09	ZS	.48686774 08	DXS	-.23516068 02	DYS	-.16077728 02	DZS	-.69720238 01				
XM	.38246390 06	YM	.27456503 05	ZM	-.26012533 05	DXM	-.83439838-01	DYM	.93230140 00	DZM	.40985468 00				
XT	.38246390 06	YT	.27456503 05	ZT	-.26012533 05	DXT	-.83439838-01	DYT	.93230140 00	DZT	.40985468 00				
RS	.15187738 09	VS	.29327596 02	RM	.38432947 06	VM	.10218263 01	RT	.38432947 06	VT	.10218263 01				
GED	.27570187 01	ALT	.16269697 06	LOS	.24606686 02	RAS	.12870042 03	RAM	.41061312 01	LOM	.26001239 03				
DUT	.35000000 02	DT	.12000000 03	DR	.17051341 01	SHA	.16335721 06	DES	.18697176 02	DEM	-.38809100 01				
DAC	.00000000 00	CCL	.25840728 03	MCL	.11049581 00	TCL	.11049581 00								

GEOCENTRIC CONIC

EPOCH OF PERICENTER PASSAGE 2356664500622026313400000 J.D.= 2438605.21642591 JULY 28,1964 17 11 39.199

SMA	.24408708 06	ECC	.97401692 00	B	.55279679 05	SLR	.12519479 05	APO	.48183203 06	RCA	.63421336 04				
VH	.14661110 00	C3	-.16330294 01	C1	.70641925 05	TFP	.62178801 05	TF	-.17271889 02	PER	.20002138 05				
TA	.16192552 03	MTA	.00000000 00	EA	.71608125 02	MA	.18651646 02	C3J	-.20370906 01	TFI	.00000000 00				

ALL VECTORS REFERENCED TO EARTH EQUATOR PLANE

X	.15667452 06	Y	.63041632 05	Z	.80776772 04	DX	.14342615 01	DY	.97257017 00	DZ	.28116150 00				
INC	.28707628 02	LAN	.16908152 02	APF	.20378266 03	MX	-.34898686 00	MY	.80607934 00	MZ	.47795831 00				
WX	.13970134 00	WY	-.45957610 00	WZ	.87708221 00	PX	-.77265530 00	PY	-.60455082 00	PZ	-.19370605 00				
QX	.61926354 00	QY	-.65062117 00	QZ	-.43955047 00	RX	.15255751 00	RY	.11936599 00	RZ	-.98105958 00				
BX	-.61926359 00	BY	.65062121 00	BZ	.43955050 00	TX	-.61622233 00	TY	.78757225 00	TZ	.00000000 00				
DAP	-.11169144 02	RAP	.21804079 03												
BTQ	.49420877 05	BRQ	-.24767313 05	B	.55279679 05	THA	.33338222 03								

HELIOCENTRIC EQUATORIAL COORDINATES

X	.90106291 08	Y	-.11221075 09	Z	-.48678696 08	DX	.24950329 02	DY	.17050298 02	DZ	.72531853 01				
R	.15192106 09	LAT	-.18688384 02	LON	.30876480 03	V	.31077970 02	PTH	-.21990135 00	AZ	.75813411 02				
XE	.89949617 08	YE	-.11227379 09	ZE	-.48686774 08	DXE	.23516068 02	DYE	.16077728 02	DZE	.69720238 01				
XT	.90332080 08	YT	-.11224633 09	ZT	-.48712787 08	DXT	.23432628 02	DYT	.17010029 02	DZT	.73818785 01				
LTE	-.18697176 02	LOE	.30870042 03	LTT	-.18680127 02	LOT	.30882594 03	RST	.15209227 09	VST	.29881788 02				
EPS	.74995022 02	ESP	.60570802-01	SEP	.10494337 03	EPM	.14723360 03	EMP	.13773992 02	MEP	.18992397 02				
MPS	.13777124 03	MSP	.57674939-01	SMP	.42170242 02	SEM	.12393571 03	EMS	.55944169 02	ESM	.11992408 00				
RPM	.23110450 06	SPN	.72833150 02												
SAC	.58666985-10														
GCE	.10159271 03	GCT	.28170321 03	SIP	.13734035 03	CPT	.92025127 02	SIN	.91594235 02	D1	.22561861 00				
REP	.16907513 06	VEP	.17555770 01	CPE	.97484329 02	CPS	.76877848 02	D2	.16806176 00	D3	.18732549-02				

1 DAYS 19 HRS. 5 MIN. 21.120 SEC. 2356666221472026173000001 J.D.= 2438607.73147129 JULY 31,1964 05 33 19.120

GEOCENTRIC EQUATORIAL COORDINATES

X	.29850499 06	Y	.17412139 06	Z	.43994134 05	DX	.64990292 00	DY	.52828978 00	DZ	.18216479 00				
R	.34836615 06	DEC	.72550883 01	RA	.30255502 02	V	.85711604 00	PTH	.79940541 02	AZ	.59406054 02				
R	.34836615 06	LAT	.72550892 01	LON	.35805418 03	VE	.25085318 02	PTE	.19279506 01	AZE	.27017413 03				
XS	-.93556355 08	YS	.10972886 09	ZS	.47583237 08	DXS	-.22981690 02	DYS	-.16731646 02	DZS	-.72550923 01				
XM	.33704213 06	YM	.16531779 06	ZM	.37879808 05	DXM	-.49758343 00	DYM	.81818858 00	DZM	.40181758 00				
XT	.33704213 06	YT	.16531779 06	ZT	.37879808 05	DXT	-.49758343 00	DYT	.81818858 00	DZT	.40181758 00				
RS	.15184656 09	VS	.29338412 02	RM	.37730922 06	VM	.10384985 01	RT	.37730922 06	VT	.10384985 01				
GED	.73039989 01	ALT	.34198829 06	LOS	.98250049 02	RAS	.13045137 03	RAM	.26127761 02	LOM	.35392644 03				
DUT	.35000000 02	DT	.48000000 03	DR	.84393963 00	SHA	.34553736 06	DES	.18262074 02	DEM	.57618937 01				
DAC	.00000000 00	CCL	.25940595 03	MCL	.24403796 00	TCL	.24403796 00								

GEOCENTRIC CONIC

EPOCH OF PERICENTER PASSAGE 2356664533342027655000001 J.D.= 2438605.29541572 JULY 28,1964 19 05 23.919

SMA	.25654037 06	ECC	.98661000 00	B	.41841011 05	SLR	.68241528 04	APO	.50964567 06	RCA	.34350742 04				
VH	.10233529 00	C3	-.15537569 01	C1	.52154738 05	TFP	.21047520 06	TF	-.15376133 02	PER	.21552259 05				
TA	.17357379 03	MTA	.00000000 00	EA	.11127205 03	MA	.58594840 02	C3J	-.20580705 01	TFI	.43089200 02				

ALL VECTORS REFERENCED TO EARTH EQUATOR PLANE

X	.29850499 06	Y	.17412139 06	Z	.43994134 05	DX	.64990292 00	DY	.52828978 00	DZ	.18216479 00				
INC	.31361147 02	LAN	.18198795 02	APF	.20046971 03	MX	-.48923678 00	MY	.71115935 00	MZ	.50487558 00				
WX	.16253819 00	WY	-.49439772 00	WZ	.85390389 00	PX	-.79673050 00	PY	-.57627783 00	PZ	-.18200095 00				
QX	.58206676 00	QY	-.65074910 00	QZ	-.48756889 00	RX	.14746868 00	RY	.10666459 00	RZ	-.98329834 00				
BX	-.58206690 00	BY	.65074925 00	BZ	.48756901 00	TX	-.58606610 00	TY	.81026325 00	TZ	.00000000 00				
DAP	-.10486331 02	RAP	.21587834 03												
BTQ	.36335064 05	BRQ	-.20746888 05	B	.41841011 05	THA	.33027415 03								

HELIOCENTRIC EQUATORIAL COORDINATES

X	.93854859 08	Y	-.10955474 09	Z	-.47539242 08	DX	.23631593 02	DY	.17259936 02	DZ	.74372570 01				
R	.15189126 09	LAT	-.18239035 02	LON	.31058646 03	V	.30193879 02	PTH	-.33144005 00	AZ	.75081514 02				
XE	.93556355 08	YE	-.10972886 09	ZE	-.47583237 08	DXE	.22981690 02	DYE	.16731646 02	DZE	.72550923 01				
XT	.93893397 08	YT	-.10956354 09	ZT	-.47545357 08	DXT	.22484106 02	DYT	.17549835 02	DZT	.76569098 01				
LTE	-.18262074 02	LOE	.31045137 03	LTT	-.18237476 02	LOT	.31059580 03	RST	.15192334 09	VST	.29532355 02				
EPS	.82563077 02	ESP	.13028593 00	SEP	.97306579 02	EPM	.13412486 03	EMP	.41510751 02	MEP	.43643786 01				
MPS	.14331163 03	MSP	.98911702-02	SMP	.36679354 02	SEM	.10167094 03	EMS	.78189705 02	ESM	.13970734 00				
RPM	.39999995 05	SPN	.81514029 02												
SAC	.58690012-10														
GCE	.10059405 03	GCT	.28083808 03	SIP	.14082134 03	CPT	.94021776 02	SIN	.91531491 02	D1	.13047323 01				
REP	.34836615 06	VEP	.85711604 00	CPE	.98550263 02	CPS	.77055966 02	D2	.10732507 01	D3	.76185481-01				

1 DAYS 19 HRS. 5 MIN. 21.120 SEC. 2356666221472026173000001 J.D.= 2438607.73147129 JULY 31,1964 05 33 19.120
CHANGE OF PHASE OCCURS AT THIS POINT EARTH IS THE CENTRAL BODY FOR INTEGRATION COWELL EQUATIONS OF MOTION

2 DAYS 2 HRS. 57 MIN. 50.728 SEC. 2356666400272021351316 43 J.D.= 2438608.05959175 JULY 31,1964 13 25 48.728

CASE 1 SPACE TRAJECTORIES

GEOCENTRIC EQUATORIAL COORDINATES

X	.32029138 06	Y	-.18771490 06	Z	.48627684 05	DX	.20228714 01	DY	.43325396 00	DZ	.28010291 00
R	.37441702 06	DEC	.74624127 01	RA	.30373517 02	V	.20876244 01	PTH	.71875039 02	AZ	.27199568 03
R	.37441701 06	LAT	.74624127 01	LON	.23972544 03	VE	.27791635 02	PTE	.40938121 01	AZE	-.27004674 03
XS	-.94206473 08	YS	.10925284 09	ZS	.47376826 08	DXS	-.22881651 02	DYS	-.16849780 02	DZS	-.73062334 01
XM	.32192654 06	YM	.18798435 06	ZM	.49143394 05	DXM	-.56837355 00	DYM	.78001521 00	DZM	.39238635 00
XT	.32192654 06	YT	.18798435 06	ZT	.49143394 05	DXT	-.56837355 00	DYT	.78001521 00	DZT	.39238635 00
XS	.15184073 09	VS	.29340519 02	RM	.37601845 06	VM	.10418442 01	RT	.37601845 06	VT	.10418442 01
GED	.75126885 01	ALT	.36803917 06	LOS	.34012244 03	RAS	.13077052 03	RAM	.30282171 02	LOM	.23963409 03
DUT	.35000000 02	DT	.30000000 02	DR	.19840371 01	SHA	.37126506 06	DES	.18180800 02	DEM	.75097041 01
DAC	.00000000 00	CCL	.25948618 03	MCL	.34216015 03	TCL	.34216015 03				

HELIOCENTRIC EQUATORIAL COORDINATES

X	.94526764 08	Y	-.10906513 09	Z	-.47328198 08	DX	.24904522 02	DY	.17283033 02	DZ	.75863364 01
R	.15188966 09	LAT	-.18155433 02	LON	.31091548 03	V	.31248855 02	PTH	.13296289 01	AZ	.74741741 02
XE	.94206473 08	YE	-.10925284 09	ZE	-.47376826 08	DXE	.22881651 02	DYE	.16849780 02	DZE	.73062334 01
XT	.94528399 08	YT	-.10906486 09	ZT	-.47327682 08	DXT	.22313277 02	DYT	.17629795 02	DZT	.76986197 01
LTE	-.18180800 02	LOE	.31077052 03	LTT	-.18155146 02	LOT	.31091604 03	RST	.15189032 09	VST	.29461173 02
EPS	.82420257 02	ESP	.13988231 00	SEP	.97439692 02	EPM	.15727339 03	EMP	.22624433 02	MEP	.10207574 00
MPS	.11247391 03	MSP	.27453512-18	SMP	.67525483 02	SEM	.97509211 02	EMS	.82350162 02	ESM	.14110097 00
RPM	.17355955 04	SPN	.81444206 02								
SAC	.58691248-10										
GCE	.10051381 03	GCT	.26267396 03	SIP	.11247391 03	CPT	.10155228 03	SIN	.10155228 03	D1	.57052062 03
REP	.37441702 06	VEP	.20876244 01	CPE	.98443460 02	CPS	.77089278 02	D2	.15379714 03	D3	-.44884791 04

SELENOCENTRIC EQUATORIAL COORDINATES

X	-.16351562 04	Y	-.26944140 03	Z	-.51571044 03	DX	.25912450 01	DY	-.34676125 00	DZ	-.11228344 00
R	.17355955 04	DEC	-.17285752 02	RA	.18935712 03	V	.26167540 01	PTH	-.64108583 02	AZ	.13807622 03
R	.17355983 04	LAT	-.10701728 02	LON	.33933150 03	VP	.26149379 01	PTP	-.64190717 02	AZP	.11489046 03
LTS	.94280089 00	LNS	.27242310 03	LTE	.58450094 01	LNE	.35482939 03				
ALT	-.24044647 01	SHA	-.16037764 04	ALP	.51316673 01	DR	-.23540927 01	DP	.37721356-01	ASD	.90000000 02
HGE	.27757974 03	SVL	-.16444751 02	HNG	.11348861 03	STA	.67273393 02				
SAC	.58691248-10										

SELENOCENTRIC CONIC

EPOCH OF PERICENTER PASSAGE 2356666402462022331642 43 J.D.= 2438608.06621774 JULY 31,1964 13 35 21.213

SMA	-.40925170 04	ECC	.10936285 01	B	.18119414 04	SLR	.80222820 03	APU	.00000000 00	RCA	.38317602 03
VH	.10945045 01	C3	.11979400 01	C1	.19831782 04	TFP	-.57248478 03	TF	.51123114 02	LTF	.51030153 02
TA	-.11945492 03	MTA	.15611886 03	EA	-.43489774 02	MA	-.87723029 01	C3J	-.21690962 01	TFI	.50964090 02
ZAE	.13175626 03	ZAP	.14584324 03	ZAC	.93425533 02	DEF	.13223773 03	IR	.41528584 04	GP	.78472725 00
OP1	.00000000 00	OY	.00000000 00	OP2	.38000000 02						

ALL VECTORS REFERENCED TO ORBIT PLANE OF TARGET

X	.15283875 04	Y	.64237642 03	Z	-.51349394 03	DX	-.26025240 01	DY	.46404317-01	DZ	.26854581 00
INC	.28507691 02	LAN	.16802832 03	APF	.33776319 03	MX	-.23108888-02	MY	-.79848262 00	MZ	.42450748 00
WX	.99000600-01	WY	.46689615 00	WZ	.87875304 00	PX	-.83651524 00	PY	.51731931 00	PZ	-.18061830 00
QX	-.53892587 00	QY	-.71720899 00	QZ	.44178066 00	RX	-.13465108-01	RY	.25020790-02	RZ	-.99990618 00
BX	.15413177 00	BY	.86523861 00	BZ	-.47708024 00	TX	.18269214 00	TY	.98317017 00	TZ	.00000000 00
SXI	-.98307794 00	SYI	.18267500 00	SZI	.13695603-01	DAI	.78472470 00	RAI	.16947339 03		
SXO	.54671994 00	SYO	-.76338544 00	SZO	.34400577 00	DAO	.20121115 02	RAO	.30560941 03		
ETE	.17929939 03	ETS	.35560462 03	ETC	.28369053 03						

BTO	.15923983 04	BRO	.86452249 03	B	.18119414 04	THA	.28497795 02				

ALL VECTORS REFERENCED TO TRUE LUNAR EQU. PLANE

X	.15956481 04	Y	-.60194270 03	Z	-.32229408 03	DX	-.18813898 01	DY	.18184161 01	DZ	-.33690097-01
INC	.26869962 02	LAN	.13743131 03	APF	.32371395 03	MX	.39578507-01	MY	-.74956443 00	MZ	.26613122 00
WX	.30574372 00	WY	.33285882 00	WZ	.89203459 00	PX	-.23652132 00	PY	.93408305 00	PZ	-.26748164 00
QX	-.92226808 00	QY	-.12920432 00	QZ	.36431824 00	RX	.57520664-01	RY	-.78217345-01	RZ	-.99527551 00
BX	.74755624 00	BY	.49629831 00	BZ	-.44141550 00	TX	.80561212 00	TY	.59244333 00	TZ	.00000000 00
SXI	-.58964434 00	SYI	.80180603 00	SZI	-.97090577-01	DAI	-.55716576 01	RAI	.12633059 03		
SXO	-.15710036 00	SYO	-.90642056 00	SZO	.39207283 00	DAO	.23083539 02	RAO	.26016720 03		
ETE	.34498668 03	ETS	.14469928 03	ETC	.23295810 03						
BTT	.16239820 04	BRT	.80361322 03	B	.18119359 04	THA	.26328101 02				

U MATRIX FOR MAPPING FORWARD — ITERATION NUMBER 2

	X	Y	Z	DX	DY	DZ	KE	RE	G
X	.40947837 01	.16579625 00	.12082392 00	.25045945-02	.89121274-04	.65330359-03	.00000000 00	.00000000 00	.00000000 00
Y	.11612678 01	.40584080 00	.59422000-01	.72901357-03	-.14286698-03	.18234925-03	.00000000 00	.00000000 00	.00000000 00
Z	.15505672 00	.33344688-01	.28440299 00	.14402604-03	-.27962878-05	-.10067949-03	.00000000 00	.00000000 00	.00000000 00
DX	.45889558 06	-.11273146 05	.86135685 04	.27891916 03	.23122841 02	.74675426 02	.00000000 00	.00000000 00	.00000000 00
DY	.12979223 05	.10916882 06	.34975166 04	.12726348 02	-.47921236 02	.29414701 01	.00000000 00	.00000000 00	.00000000 00
DZ	-.41612569 04	.38649084 04	.10125987 06	.14947090 02	.13573943 00	-.42640558 02	.00000000 00	.00000000 00	.00000000 00
KE	-.61194899 00	-.57870550-01	-.26828021-01	-.33788331-03	.45874286-06	-.94853993-04	.10000000 01	.00000000 00	.00000000 00
RE	-.60211502 02	.18828248 02	.20321274 01	-.68285191-01	.60572550-03	-.16718238-01	.00000000 00	.10000000 01	.00000000 00
G	.10006608 01	-.37245428 00	-.12676902 00	.57066423-03	.19779762-03	.21446396-03	.00000000 00	.00000000 00	.10000000 01
KM	.34307557 01	-.41493056 00	-.97892193-01	.22599502-02	.30614523-03	.63373989-03	.00000000 00	.00000000 00	.00000000 00
RI(01)	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00
LO(01)	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00
RI(03)	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00
LA(03)	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00
LO(03)	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00
RI(04)	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00
LA(04)	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00
LO(04)	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00
RI(05)	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00
LO(05)	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00

	KM	RI(01)	LO(01)	RI(03)	LA(03)	LO(03)	RI(04)	LA(04)	LO(04)
X	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00
Y	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00
Z	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00
DX	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00
DY	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00
DZ	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00
KE	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00
RE	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00
G	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00
KM	.10000000 01	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00
RI(01)	.00000000 00	.10000000 01	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00
LO(01)	.00000000 00	.00000000 00	.10000000 01	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00
RI(03)	.00000000 00	.00000000 00	.00000000 00	.10000000 01	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00
LA(03)	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.10000000 01	.00000000 00	.00000000 00	.00000000 00	.00000000 00
LO(03)	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.10000000 01	.00000000 00	.00000000 00	.00000000 00
RI(04)	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.10000000 01	.00000000 00	.00000000 00
LA(04)	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.10000000 01	.00000000 00
LO(04)	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.10000000 01
RI(05)	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00
LO(05)	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00

	RI(05)	LO(05)
X	.00000000 00	.00000000 00
Y	.00000000 00	.00000000 00
Z	.00000000 00	.00000000 00
DX	.00000000 00	.00000000 00
DY	.00000000 00	.00000000 00
DZ	.00000000 00	.00000000 00
KE	.00000000 00	.00000000 00
RE	.00000000 00	.00000000 00
G	.00000000 00	.00000000 00
KM	.00000000 00	.00000000 00
RI(01)	.00000000 00	.00000000 00
LO(01)	.00000000 00	.00000000 00
RI(03)	.00000000 00	.00000000 00
LA(03)	.00000000 00	.00000000 00
LO(03)	.00000000 00	.00000000 00
RI(04)	.00000000 00	.00000000 00
LA(04)	.00000000 00	.00000000 00
LO(04)	.00000000 00	.00000000 00
RI(05)	.10000000 01	.00000000 00
LO(05)	.00000000 00	.10000000 01

COVARIANCE MATRIX AT IMPACT — ITERATION NUMBER 2

	X	Y	Z	DX	DY	DZ	KE	RE	G
X	.76823572-01	-.25931951 00	.74662940 00	-.76213664-04	.21622266-03	-.34818544-03	.97393923-01	.71499208-02	-.11220696-02
Y	-.25931951 00	.25104106 01	-.68693043 01	.64631291-03	-.19245176-02	.32412558-02	.74491395 00	-.56511254-01	.46922873-02
Z	.74662940 00	-.68693043 01	.19003514 02	-.17634430-02	.52908257-02	-.89588706-02	-.17660675 01	.15650606 00	.13750467-01
DX	-.76213664-04	.64631291-03	-.17634430-02	.17006115-06	-.49838096-06	.83186587-06	.16820050-03	-.14772800-04	.66177179-06
DY	.21622266-03	-.19245176-02	.52908257-02	-.49838096-06	.14824639-05	-.24949428-05	-.50724594-03	.43852938-04	.29025083-05
DZ	-.34811544-03	.32412558-02	-.89588706-02	.83186587-06	-.24949428-05	.42243868-05	.87046298-03	-.73726412-04	.72350672-05
KE	.97393923-01	.74491395 00	-.17660675 01	.16820050-03	-.50724594-03	.87046298-03	.23419515 01	-.11571507-01	.65541669-02
RE	.71499208-02	-.56511254-01	.15650606 00	-.14772800-04	.43852938-04	-.73726412-04	-.11571507-01	.13125908-02	.97503653-04
G	-.11220696-02	.46922873-02	.13750467-01	-.66177179-06	.29025083-05	-.72350672-05	.65541669-02	.97503653-04	.89780880-01
KM	-.22655928-01	.96027062-01	-.22102122 00	.29945980-04	-.74436476-04	.10409909-03	.19079141-01	-.22164129-02	.41077735-02
RI(01)	.11047179-02	-.90654601-03	.16889609-02	.88096206-06	-.23647979-07	.49531271-07	.56797750-01	.21174448-04	-.48810453-03
LO(01)	.43781086-04	.98002864-04	-.88742106-04	.23647979-07	-.49531271-07	.52165814-07	.59853821-03	.58737314-07	.20788301-04
RI(03)	.11848811-02	-.10033324-01	.28719846-01	-.25637652-05	.78733083-05	-.13655932-04	-.95434430-02	.23769043-03	.32240217-04
LA(03)	.99628340-06	.76864795-04	-.19908739-03	.18958949-07	-.56316303-07	.93927179-07	.15352399-04	-.13065486-05	-.28481707-07
LO(03)	-.12463654-03	.86106596-03	-.23747789-02	.22923580-06	-.67435049-06	.11213730-05	.31610765-03	-.20252136-04	.29594182-05
RI(04)	-.38167265-03	.15352399-02	-.39940236-01	.36656854-05	.11087913-04	-.18936902-04	-.19856429-01	.28869519-03	.98582038-04
LA(04)	.51833980-05	-.12326938-03	.33361520-03	-.30362250-07	.92527781-07	-.15862538-06	-.78497351-04	.25873037-05	.17611564-05
LO(04)	-.12782355-03	.87385412-03	-.24097803-02	.23278371-06	-.68394813-06	.11352591-05	.15714878-03	-.20542879-04	.43867034-05
RI(05)	.22286422-02	-.14902555-01	.42429803-01	-.39063499-05	.11756800-04	-.19884154-04	.57131375-02	.35859197-03	.81466942-04
LO(05)	-.12030457-03	.85136949-03	-.23427071-02	.22626772-06	-.66528116-06	.11051568-05	.24682402-03	-.19899743-04	.44741727-05

	KM	RI(01)	LO(01)	RI(03)	LA(03)	LO(03)	RI(04)	LA(04)	LO(04)
X	-.22655928-01	.11047179-02	.43781086-04	.11848811-02	.99628340-06	-.12463654-03	-.38167265-03	.51833980-05	-.12782355-03
Y	.96027062-01	.90654601-03	.98002864-04	-.10033324-01	.76864795-04	.86106596-03	.15352265-01	-.12326938-03	.87385412-03
Z	-.22102122 00	.16889609-02	-.88742106-04	.28719846-01	-.19908739-03	-.23747789-02	.39940236-01	.33361520-03	-.24097803-02
DX	.29945980-04	.88096029-07	.23647979-07	-.25637652-05	.18958949-07	.22923580-06	-.36656854-05	-.30362250-07	.23278371-06
DY	-.74436476-04	.17995242-07	-.49531271-07	.78733083-05	-.56316303-07	-.67435049-06	.11087913-04	.92527781-07	-.68394813-06
DZ	.10404909-03	-.35111116-07	.52165814-07	-.13655932-04	.93927179-07	.11213730-05	-.18936902-04	-.15862538-06	.11352591-05
KE	.19079141-01	.56797750-01	.59853821-03	-.95434430-02	.15352399-04	.31610765-03	-.19856429-01	-.78497351-04	.15714878-03
RE	-.22164129-02	.21174448-04	.58737314-07	.23769043-03	-.13065486-05	-.20252136-04	.28869519-03	.25873037-05	-.20542879-04
G	.41077735-02	-.48810453-03	.20788301-04	.32240217-04	-.28481707-07	.29594182-05	.98582038-04	.17611564-05	.43867034-05
KM	.27917855-01	-.67555274-03	.49062728-04	.46260878-05	.50147331-04	-.42503281-03	-.27749806-05	.55929868-04	
RI(01)	-.67555274-03	.10247617 00	-.33324110-03	.32298388-03	.88468032-06	.11258772-05	.29005305-02	.42267872-05	-.10025192-04
LO(01)	.49062728-04	-.33324110-03	.22071013-05	-.15228585-05	.23397614-07	.84022531-07	.17008968-04	-.47299767-06	.86429536-07
RI(03)	.61432014-04	-.32298388-03	.15228585-05	.33786214-02	.41489197-04	-.37802681-05	.11476978-03	.47930495-06	-.36766266-05
LA(03)	.46260878-05	.88468032-06	.23397614-07	.41483197-04	.54581991-06	.33270169-07	-.62481485-06	-.73072263-08	.30198977-07
LO(03)	.50147331-04	.11258772-05	.84022531-07	.37802681-05	.33270169-07	.38959708-06	-.58318610-05	-.46311178-07	.37217489-06
RI(04)	-.42503281-03	.29005305-02	.17008968-04	.11476978-03	-.62481485-06	-.58318610-05	.33338294-02	-.34490378-04	-.78193809-05
LA(04)	-.27749806-05	.42267872-05	-.47299767-06	.47930495-06	-.73072263-08	-.46311178-07	-.34490378-04	.59845036-06	-.45458953-07
LO(04)	.55929868-04	-.10025192-04	.86429536-07	-.36766266-05	.30198977-07	.37217489-06	-.78193809-05	-.45458953-07	.41362332-06
RI(05)	.56802807-03	.37927577-02	-.11446848-04	.61042573-04	-.46679594-06	-.56846392-05	.10708535-03	.18695865-05	-.67077247-05
LO(05)	.53893163-04	-.57702871-05	.10240330-06	-.42332243-05	.28417624-07	.36971597-06	-.50471583-05	-.50459689-07	.37179442-06

	RI(05)	LO(05)
X	.22286422-02	-.12030457-03
Y	-.14902555-01	.85136949-03
Z	.42429803-01	-.23427071-02
DX	-.39063499-05	.22626772-06
DY	.11756800-04	-.66528116-06
DZ	-.19884154-04	.11051568-05
KE	.57131375-02	.24682402-03
RE	.35859197-03	-.19899743-04
G	.81466942-04	.44741727-05
KM	-.56802807-03	.53893163-04
RI(01)	.37927577-02	-.57702871-05
LO(01)	-.11446848-04	.10240330-06
RI(03)	.61042573-04	-.42332243-05
LA(03)	-.46679594-06	.28417624-07
LO(03)	-.56846392-05	.36971597-06
RI(04)	.10708535-03	-.50471583-05
LA(04)	.18695865-05	-.50459689-07
LO(04)	-.67077247-05	.37179442-06
RI(05)	.64937832-03	-.62104760-05
LO(05)	-.62104760-05	.38273119-06

IMPACT PARAMETERS 64707731 132548

N MATRIX (TARGET ORBITAL PLANE)

	B.RO	B.TO	TL	C3	S.TS	S.RS
B.RO	.32567331 02	-.17931574 02	.15664596-03	.36250858-01	-.35001573-02	.20614282-02
B.TO	-.17931574 02	.10351956 02	-.11733032-03	-.20811617-01	.20081267-02	-.11816563-02
TL	.15664593-03	-.11733030-03	.29589390-08	.23679449-06	-.22815368-07	.13315637-07
C3	.36250857-01	-.20811617-01	.23679453-06	.42162143-04	-.40702855-05	.23933820-05
S.TS	-.35001566-02	.20081264-02	-.22815365-07	-.40702847-05	.39317660-06	-.23121759-06
S.RS	.20614276-02	-.11816559-02	.13315637-07	.23933814-05	-.23121759-06	.13599567-06

NORMALIZED N MATRIX

	B.RO	B.TO	TL	C3	S.TS	S.RS
B.RO	.99999999 00	-.97659862 00	.50461493 00	.97828606 00	-.97814363 00	.97952285 00
B.TO	-.97659861 00	.10000000 01	-.67039540 00	-.99616954 00	.99537345 00	-.99590380 00
TL	.50461483 00	-.67039531 00	.10000000 01	.67041273 00	-.66890684 00	.66379105 00
C3	.97828602 00	-.99616954 00	.67041284 00	.99999998 00	-.99970000 00	.99951227 00
S.TS	-.97814344 00	.99537332 00	-.66890677 00	-.99969982 00	.10000000 01	-.99991825 00
S.RS	.97952258 00	-.99590353 00	.66379105 00	.99951199 00	-.99991825 00	.10000000 01

DM/DQO MATRIX

	B.RO	B.TO	TL	C3	S.TS	S.RS
X	.41882097-02	-.13192300 01	-.13722824 01	.13644447-04	.19479215-03	.25684024-04
Y	.19841481 00	-.95093483 00	-.31187259 00	.12471388-04	.54902795-04	.87218704-05
Z	-.42064566 00	-.25896343 00	.82498427-02	.35388161-05	.14478806-04	-.18264600-05
DX	-.12347015 05	-.98304786 05	-.16077389 06	.27874441 01	.21518375 02	.29709148 01
DY	.69016132 05	-.17811702 06	.18506068 05	.17691553 00	.14253490 01	-.17516613 00
DZ	-.16050349 06	-.66460121 05	.22881221 05	-.18420148 00	-.43086767-01	.70506358 00

B	.18119257 04
B.RO	.86451081 03
B.TO	.15923868 04
B.RT	.80361322 03
B.TT	.16239820 04
TL	.51030154 02
SMAA	.65232521 01
SMIA	.60536616 00
THETA	.60888041 02
DEL T	.19582607 00
DEL B	.65512814 01
DEL S	.21433610 00
TF	.50964090 02

N MATRIX (TARGET EQUATORIAL PLANE)

	B.RT	B.TT	TL
B.RT	.33892177 02	-.17039781 02	.16097540-03
B.TT	-.17039781 02	.90271094 01	-.11131613-03
TL	.16097536-03	-.11131611-03	.29589390-08

APPENDIX G

ODP format description

Block No. references are to Appendixes E and F. All units are in kilometers and seconds unless otherwise specified.

Block No. 1 — Control card input.

Block No. 2 — Input covariance matrix of estimated parameters from postmaneuver data a priority.

Block No. 3 — Inverse of Block No. 2

Block No. 4 — Trajectory based on injection conditions from previous iteration. Its format is explained in Appendix D.

Block No. 5 — The normal equation coefficients combined with the a priori matrix at injection epoch.

Block No. 6 — Correlation matrix based on Block No. 5

Block No. 7 — Solution vector and statistics of estimated parameters from last iteration (see next page for explanation of format).

Block No. 8 — Covariance matrix of estimated parameters, at injection epoch, from last iteration.

Block No. 9 — Correlation matrix of estimated parameters, at injection epoch, from last iteration.

Block No. 10 — Residual listings and data statistics for the tracking stations. First the residuals will be listed and then followed by the statistics.

BLOCK 8

The above sequence is repeated until the orbit converges. In the last iteration a trajectory based on the converged estimated parameters is run out to lunar encounter. See Appendix D for explanation of trajectory format.

Following the trajectory printout is the U matrix which maps the covariance matrix at injection to encounter. Immediately below the U matrix is the covariance matrix on the estimated parameters at impact or closest approach epoch. This is formed by mapping the covariance matrix at injection to impact in double precision.

There are three blocks following the covariance matrix. The first block is a covariance matrix N formed by mapping the upper 6×6 matrix of the covariance of impact into a new coordinate system (explained in Appendix A of this Report) (σ^2_{TL} is in hr^2). The second block is simply the correlation matrix of the first block covariance matrix. The third block is a mapping matrix which maps injection components into the **B·T**, **B·R**, etc. system.

B = The vector measured from the center of the Moon perpendicular to the incoming asymptote (in kilometers).

B·RO = The **B** vector dotted on the **R** axis in km (**T** axis in the Moon's orbital plane).

B·TO = The **B** vector dotted on the **T** axis in km (**T** axis in the Moon's orbital plane).

B·RT = The **B** vector dotted on the **R** axis in km (**T** axis in the equatorial plane of the Moon).

RESIDUAL LISTING FORMAT

Frequency XXXX.X Last digits in transmitter frequency 2966 XXXX.X in cps

GMT	*TC*	Q		*CC3*	
XX XX XX hr min sec	X Doppler count time in sec	X Transmitting station	.XXXXXXXX XX Two-way doppler (CC3) value in cps (floating point number)	.XXX XX Associated weight in floating point	.XXXX[16] Residual (observed minus calculated) in cps

[16]Residuals followed by an asterisk (*) have been deleted from fit.

B·TT = The **B** vector dotted on the **T** axis in km **T** axis in the equatorial plane of the Moon).

TL = Linearized time of flight in hours.

SMAA = The largest eigenvalue of the upper 2×2 of the N matrix (commonly called the semimajor axis of a 40% dispersion ellipse in the **B** plane).

SMIA = The semiminor axis of the dispersion ellipse or the other eigenvalue of the upper 2×2.

THETA = The orientation angle of the semimajor axis of the dispersion ellipse measured counterclockwise from the **T** axis.

DEL T = Uncertainty in the time of flight in sec.

DEL B = $(N_{11} + N_{22})^{1/2}$ where N's are from the first block of this sheet.

DEL S = V_∞ (*DEL T*) The position uncertainty in the direction of the incoming asymptote. Where V_∞ = hyperbolic excess velocity in km/sec.

TF = Orbital time of flight, in hours from injection epoch to impact or closest approach.

The block following the **B** plane parameters is formed by rotating the upper 3×3 of the covariance matrix N (target orbital plane) into the target equatorial plane.

BLOCK 7

JOB TITLE

Iteration number	Epoch year/month/day			XX XXX XX	Clock XXXXXX	SOS* XXXXX QSOS** XXXXX
	GMT			hr, min, sec	(PC time now) hr, min, sec	Floating pointing numbers
Q	DQ	STDEVDQ	OLD Q	NEW Q	NOMINAL Q	DQ (NOM)
X, Y, Z = Position space-fixed Cartesian component in km DX, DY, DZ = Velocity space-fixed Cartesian in km/sec RI = Radius in km $KE = GM_{\oplus}$ in km^3/sec^2 LA = Latitude in deg RE = Radius of Earth to scale ephemeris in km LO = Longitude in deg $KM = GM_{\mathbb{C}}$ in km^3/sec^2	Difference in estimated parameters from previous iteration and this iteration	Standard deviations on estimated parameters	Value of estimated parameters from previous iteration (Initial estimate on 1st iteration)	Value of estimated parameters on this iteration	Initial estimate of parameters	Total difference in new Q and nominal Q

*Weighted sum of the squares of the residuals.

**Weighted sum of the squares of the residuals plus the product $\delta x^T \Gamma^{-1} \delta x$ where δx is the difference in the a priori Q and the value of Q on the particular iteration, and Γ is on a priori covariance on Q.

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